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EAST EUROPE REPORT

SCIENCE AND TECHNOLOGY

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BULGARIA

U.S. PLANS FOR ANTIMISSILE DEFENSE, LASER WEAPONS OUTLINED

[Editorial Report] Sofia BULGARSKI VOIN in Bulgarian No 12, 1984 on pages 30 and 31 carries an article entitled "Imperial Space Ambitions?", which sketches the steps taken by the Reagan administration to set up a program for the "strategic defense" of outer space, and includes a description of new laser, corpuscular, and radiation weapons to be developed in connection therewith. For text see JPRS-EPS-85-019, 7 Feb 85, pp 21-27.

CSO: 2200/86

BULGARIA

PROTECTIVE MEASURES AGAINST BACTERIOLOGICAL WEAPONS

Sofia ARMEYSKI PREGLED in Bulgarian No 12, 1984 p 82-85

[Article by engineer Colonel Todor Vachev: "The Enemy's Bacteriological Weapon and Defending Against It"]

[Text] In their aggressive plans for world domination, the American imperialists and their allies in NATO allocate a great role not only to nuclear and chemical weapons, but also to bacteriological weapons. Currently the ideologues of bacteriological warefare are organizing and financing research and production of the most varied bacteriological agents for infecting people, animals, and plants. Consequently, in a future war, our probable enemies will utilize one of the oldest weapons of mass infection, a bacteriological one. This is why it is necessary to study the combat characteristics of bacterial agents, their effect on the human organism, and the measures for defending against them.

We will share the experience of an exemplary drill on the enemy's bacteriological weapons and defending against them, conducted by the company commanded by First Lieutenant Denev. It was determined that the leader of the drill would be the medic of the squadron, officer Yonov. The drill was carried out in the office for the defense against the enemy's mass infection weapons, where there were posters and diagrams of bacteriological weapons, transparencies prepared for an overhead projector, disinfecting substances, etc.

After the topic, the aim of the drill, and the study questions had been announced, the leader explained in a short introduction that the concept of bacteriological weapons comprises combat munitions filled with disease-causing microorganisms and separated from those toxins designated for infecting people, plants, and animals. With the development of the technology for raising and breeding disease-causing viruses in an aritificial way, the real possibility arises for utilizing these biological agents as a means of spreading infection.

The term "bacteriological weapon" in the narrow sense does not fit the situation where crops are included, besides the people and animals, as an object of attack. But since this has gained popularity, we must accept it not in the narrow, but in the broad sense.

In order to make use of bacterial agents, the enemy can utilize bombs dropped

from the air, cassettes, devices, and containers loaded with infected insects and ticks. Warheads have been developed for directed and nondirected rockets; these warheads are equipped with stabilizing or self-scattering smaller bombs. In addition to this, there are transportable dispersion devices for influencing living things through diversionary methods, such as infecting a place, produce, fodder, source of water, as well as spreading infected insects, ticks, and rodents.

The leader of the drill explained that with combat use of bacterial agents, the basis of the infecting influence of the bacteriological weapons is provided by bacterial agents such as bacteria, viruses, rickettsiae, and molds (under the general heading of microbes), and poisons (toxins) developed from certain bacteria.

The bacteria evoke infectious diseases such as plague, choloera, tularemia, brucellosis, Siberian canker, and hoof and mouth disease. They represent single-celled microorganisms which can be seen only under a microscope, and they multiply by simple division; under favorable conditions, one bacterium could form two every 25-30 minutes. Certain types of bacteria, such as Siberian canker and tetanus, can turn into spores with tremendous resistance to high temperatures.

The viruses are hundreds and thousands of times smaller than the bacteria and can be seen only with electron microscopes. They can develop only in living tissue and thus they are called internal cell parasites. They stand up well to drying and freezing. They cause many diseases, such as natural measles, yellow fever, encephalitis, and poliomyelitis.

According to their size, rickettsiae occupy a middle place between bacteria and viruses. Like the viruses, they live and develop only in the tissue of certain insects and ticks. They cause typhus and Q fever.

Molds are single-celled and multicelled organisms and can appear in the form of spores. Like bacteria, molds come from plants, are more complex in structure, are much more resistant to physical-chemical effects, and they even bear up under drying and the influence of disinfecting substances. They cause various diseases, such as histoplasmolysis and noncardiosis.

Toxins are the strongest poisons whicy are formed in the process of life among the infectious microbes. They are resistant to the effects of unfavorable conditions; however, high temperatures and disinfecting substances quickly render them harmless. It is thought that the bolutism toxin is one type of bacterial agent which would most likely be used by the enemy.

As he used the diagram, the drill leader pointed out how the enemy could use the following bacterial agents for infecting humans: X-R botulism toxin, sources of plague, tularemia, brucellosis, Siberian canker, hoof and mouth disease, cholera, epidemic typhus, psittacosis, Q fever, yellow fever, natural measles, and other diseases. He briefly characterized the basic infectious diseases as he explained that, as they enter the organism, the bacterial agents cause infection or intoxication in a human through various modes of

infection, through the respiratory system, through food and water, and through the skin (by means of wounds and insect bites).

In contact with people, the bacterial agents can cause illnesses that vary in seriousness: some of them can be fatal, and others can cause disability for a lengthy period.

The bacterial agents have a long-term effect, which is conditioned by a number of factors, such as the spread of infectious diseases from one person to another (plague, cholera, natural measles). Because of this, favorable conditions for epidemics could arise. The infection could begin not only at the time of utilizing the bacterial agent, but even after a lengthy period, if it has not been disinfected.

A characteristic trait of a bacteriological weapon is that it has a concealed (incubation) period. The incubation period for infection with plague and cholera can be from several hours to 1-2 days, with brucellosis up to 2-3 weeks, and with typhus 10-14 days.

In approaching the study of external signs of the utilization of bacterial agents, officer Yonov directed the attention of those in attendance to the fact that the enemy, in order to achieve a tremendous effect, would try to use the bacteriological weapon suddenly; according to this, great significance in organizing the proper defense is accorded to the timely discovery of training in and utilization of this weapon.

The discovery of bacterial agents which are used by the enemy and determining their technical aspects takes place through external signs of the enemy's use of bacterial agents, such as the presence of drops or dust-like substances on the soil and the plant life, as well as large pieces or separate parts of combat munitions; the appearance of a cloud, which spreads out behind an enemy airplane; tossing out containers and the concentration of insects, ticks, and rodents in the area; disease and widespread mortality among animals.

In all cases when there is an explosion of combat munitions with a characteristic sound or the suspicion of an area being infected, a chemical investigation must be carried out first, in order to determine the presence of poisonous substances, and if there are none it is presumed that bacterial agents had been used. After that, samples are taken from the air, soil, plants, insects, ticks, and rodents. The samples are sent off to medical laboratories for study.

Officer Yonov examined the question of defending against bacteriological weapons in especially great detail. For this purpose, individual means of defense are used to protect the respiratory organs and skin of a person safely, as well as special hand-held devices for defense and rendering these weapons harmless, and various nets and ointments for protecting a person from insect and tick bites. Individual defense means against bacteriological weapons mentioned by the drill instructor include gas masks for all the troops, a defensive overcoat, protective socks and sleeves, impermeable and light protective clothing. The collective means include various types of covers and combat

technology equipped with filtration and ventillation aggregates and other light and heavy types of devices.

Under a bacteriological attack, the personnel located in an open place, in open trenches and slit trenches, upon a signal of radioactive, chemical, or bacteriological contagion, don gas masks and protective outer clothes, such as a cape. In closed, nonventilated equipment, in closed machines and tanks without filtration and ventilation aggregates, gas masks are also donned. When moving around in an area infected with bacterial agents, on command of the commander the personnel don protective socks and sleeves and put on the capes or light protective clothing and continue to carry out the task assigned. At the first opportunity, according to the directive of the commander, partial sanitary work is carried out by shaking (sweeping) the clothes and the protective devices, covering the exposed parts of the body with IPP and partial disinfection of the equipment and combat technology with IDK, DK-5, PAD, and other devices with disinfecting and degassing mixtures.

After carrying out the partial specialized work, the individualized protective devices are not removed before the full specialized work is completed. This is conducted after the task has been carried out, if the combat conditions permit after emerging from the firing of contagion.

In the defense of the personnel against bacteriological agents, taking anti-epidemic, sanitary, and prophylactic measures plays a great role. These include: maintaining the rayons occupied by the troops in good sanitary and hygienic condition; the personnel maintaining the rules of proper hygiene; immunization of the entire staff; making certain that underwear is treated with antiparasitical means; special ointments and fluids for spreading over the exposed parts of the body.

In treating the question of the personnel's rules of behavior under fire from bacterial contagion, the drill leader explained that all people and combat technology located in the scope of the contagion are assumed to be infected with the bacterial agents. All persons who are in the line of this type of fire or come in contact with those infected or contagious objects are considered to be infected by the bacteriological weapon.

Observation is established for those troops which are subjected to the effect of the bacteriological weapon. The observation is a system of measures intended to strengthen the medical observation of the personnel infected by the bacteriological weapon and carrying out a number of antiepidemic, isolation, and other measures. If it is established that the enemy has used bacteria that cause especially dangerous diseases (plague, cholera, natural measles), or an epidemic of other infectious illnesses appears, a quarantine is established. A quarantine is a system of antiepidemic measures which are directed toward isolating the source and liquidating the infectious diseases in it.

As the first signs of illness appear, the commander is informed immediately. In order to avert the appearance of infectious diseases among the personnel located in the infected zone, the commander gives orders to provide various medicines or conduct preventative immunizations. The drill leader

demonstrates some medicinal preparations which can be utilized. Open wounds must be bandaged.

In order to protect the staff in the center of the bacteriological contagion, along with the correct use of the individual defense devices, the rules of personal hygiene must be strictly observed. The individual defense devices are removed after emerging from the center of the infection and carrying out the sanitation and disinfection, and only with the permission of the comander. The combat technology and other euqipment which has been infected must not be touched with these defense devices before they have been disinfected. In the region infected by the bacterial agent, it is forbidden to use water or food products without the permission of the medical organs, and only after laboratory study of them.

It is forbidden to come into contact with personnel and the local populace which has not been infected by the bacteriological weapon. The troops must wash their hands regularly, undergo preventative immunizations, and take other antiepidemic measures. With the appearance of the first signs of illness, such as weakness, headache, a rise in temperature, vomiting, disorientation, etc., the commander must be informed immediately and medical help must be sought.

Defense against insects and ticks is possible by destroying them with disinfecting mixtures and utilizing the individual means of defense. A safe defense against insects and ticks is attained by the correct use of clothing and repelling (odorous) preparations. In order to attain this, all buttons are buttoned and the cuffs of sleeves are wrapped with bandaging. The defensive qualities are increased if the protective sleeves, socks, and cape are in place. Uncovered parts of the body and light items of clothing are treated with preparations to repel insects and ticks.

At the end of the drill, officer Yonov conducted a quiz to determine the level of understanding with regard to the material covered and assigned tasks of self-study, and pointed out that the practical questions of defending against bacteriological weapons will be treated during the following drill on defending against weapons of mass destruction and the time of the studies.

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USE OF HIGH TECHNOLOGY FOR MILITARY PURPOSES DISCUSSED

Lieutenant General Molkhov Interviewed

Sofia NARODNA ARMIYA in Bulgarian 4 Jan 85 pp 1-2

[Interview materials prepared for publication by Col Avram Molkhov, Col Stefan Rikov, Lt Col Engineer Veselin Stoyanov and Capt Georgi Vuchev]

[Text] As we know, in several consecutive speeches, particularly the one delivered at the November 1984 BCP Central Committee Plenum, with April far-sightedness and extent, with depth and perspective and with his typical daring and revolutionary scope, Comrade Todor Zhivkov discussed major problems of our country's development, related to scientific and technical progress and science as a direct productive force.

Such questions entirely apply to the BNA [Bulgarian People's Army] as well. A great deal has been accomplished in recent years to apply computers in solving some problems of troop control, automation of individual combat training processes, material and technical accountability, etc.

In all likelihood, a great deal remains to be done to resolve successfully problems which the application of scientific and technical achievements raise in our people's army. This was the topic of the meeting-discussion held in the editorial premises, with the participation of Lt Gen Yako Molkhov and officers Lyuben Georgiev, Stoyan Andreev, Stefan Bistrekov, and Khristo Svetkov.

The following topics were discussed: What are the problems currently facing the BNA with the application of scientific and technical achievements, what conditions and prerequisites exist to this effect and what are the requirements concerning cadres to ensure their application in troop activities?

It is inconceivable under contemporary conditions to speak of upgrading the combat readiness of the troops without the fullest possible utilization of the achievements of the scientific and technical revolution.

What is the social prestige enjoyed by innovators and inventors in the armed forces? How many honored workers in science and technology are there in the BNA?

Every commander must know the new developments in his professional area throughout the world. He must know and utilize the full opportunities of the various types of equipment and armaments.

The involvement of an increasing range of specialists in problems of scientific and technical achievements should become the concern of all commanders at all levels.

The Editors: The time has come to stop considering the scientific and technical revolution as something external but practically to apply its achievements in the daily activities of the troops. It is true that a great deal has been accomplished in this respect in the units but also that a great deal remains to be accomplished in the thoughts and actions of all of us. What could our interlocutors share with us in this respect?

Lieutenant General Molkhov: The question of the application and utilization of scientific and technical progress plays a central role in the resolutions of the 12th BCP Congress, the National Party Conference and the subsequent speeches by Comrade Todor Zhivkov, mainly the one delivered at the November BCP Central Committee Plenum. The question legitimately arises--why is our party paying such great attention to this problem? Why is it that the party resolutions and the speeches and statements by Comrade Todor Zhivkov emphasize the stipulation that laying the material and technical foundations for a developed socialist society is inconceivable without the utilization and application of the achievements of the scientific and technical revolution? Let us emphasize two most essential aspects.

We are witnessing the type of dynamic development of the processes of the scientific and technical revolution which is leading to significant and fast changes in the development of modern equipment and technology and the utilization of scientific and technological achievements. This is exemplified by the creation of a microcomputer technology, which brought about exceptionally dynamic changes in socioeconomic life and in cadre training. For example, we previously believed that knowledge becomes obsolete in 7-8 years. Today the process is much faster.

The second essential aspect is the global nature of the scientific and technical revolution. There is no area in life, there is no place in which it is not manifested.

If we apply these conclusions to the conditions of our army life, bearing in mind the increasing confrontation in the world between the two sociopolitical

systems, in the military area above all, we can define with absolute accuracy the place and role of scientific and technical progress in the armed forces. The introduction of new equipment and armaments leads to revolutionary changes in military affairs. It would be inconceivable to speak of upgrading the combat readiness of the troops and the country's defense capability without the application and utilization of scientific methods, electronics and computers. For example, the stipulation of operative control was considered important in the past as well. In modern combat, however, the drastic and fast changes in the situation demand a multiple shortening of the length of the control cycle. This applies not only to control efficiency but to upgrading its continuity and stability.... Whereas previously it may have been admissible for an army unit to become lost or for its control to be disturbed for a while, under contemporary conditions the type of changes which could take place during such a time interval could be so drastic that the restoration of the control cycle may become pointless.

Editors: Unquestionably, such requirements demand a new attitude toward NTP [scientific and technical progress] and military-technical achievements. However, what are the conditions and prerequisites for this?

Lieutenant General Molkhov: Our country is in one of the leading positions in the world in per capita production of computers. We have made a significant advance in the production of automation and electronic facilities. Other conditions exist as well. The main feature, however, is related to the subjective factor, to the preparedness of cadres to apply and utilize such accomplishments. In the course of a number of conferences and meetings, Army Gen Dobri Dzhurov, minister of national defense, has categorically emphasized that today the subjective element is the main factor in the application of scientific and technical progress in the armed forces.

The dynamics of progress demand the steady updating of the knowledge of the cadres and a psychological attuning to the utilization of new developments. Unfortunately, we occasionally come across feelings which hinder the accelerated application of some achievements.

In the past as well, the achievements of science and technology have been used in upgrading the army's combat readiness. Today, however, it is a question of applying a broader scope and greater understanding in our work.

Innovativeness can be displayed by anyone, such as the squad or company commander, in organizing and carrying out the training process and in its material support, conducting training exercises not as he did yesterday, but seeking greater efficiency, utilizing contemporary visual means and loading more and utilizing the intellectual capabilities of subordinates. Naturally, the possibilities of squad and company commanders and of senior commanding officers differ. Their work in applying the achievements of the scientific and technical revolution is of decisive, of determining significance in the development of the respective branch or service and enhancing its combat readiness and combat capability. This is necessary if we are to achieve a radical upswing in the work and to surmount the weaknesses we mentioned.

The BNA makes extensive use of computers and, of late, of microcomputers as well. Programs are being created in the higher military schools to meet the needs of the troops and the training process. In the unit where Officer Dmitrov serves, on the commander's initiative a substantial change was made in artillery fire training as a result of the use of microcomputers. The troops were able to lower the norms from a few minutes to a few seconds. Computers will also be applied in the unit where Officer Kirilov serves. This equally applies to the aviation unit in which Officer Doganov serves. Consequently, whenever a commander displays initiative the results are obvious....

Officer Georgiev: Let me begin by welcoming this initiative of the editors. The question of the application of scientific and technical progress in army life has always been on the agenda. Today, however, it has been raised particularly urgently.

Scientific knowledge and technical achievements become rapidly obsolete today. There have even been cases in which some types of equipment are obsolete even before they have been applied or are in the process of being applied.

When we speak of the application of achievements we should not mean exclusively new topics for research and development but the other part as well: the study and mastery of the equipment and armaments and the full utilization of their combat potential by the entire personnel. This is as difficult as the development and creation of new prototypes. Here again we face the problem of psychological tuning we discussed....

Another major obstacle is the question of the social prestige of army innovators and inventors! How many honored workers in science and technology are there in the Bulgarian People's Army? I do not have precise figures but I know that they are the exception. Yet we are discussing dedicated people who are applying on a tremendous scope and within a short time the latest types of armament and equipment and are using original solutions in this area. It is a good thing that painters, architects and other creative workers are being generously awarded titles and that their work is being encouraged. However, why is this virtually absent in the BNA, where a number of scientific achievements and inventions have been created, which will show up in the civilian sector in a few years? Let us not even mention the tribulations of some army innovators. NARODNA ARMIYA should take up and discuss the question of the feel military cadres have for the new. Most young officers in the different arms and services have engineering training. This is a firm scientific potential which could be used. So far, however, we are still not using it efficiently. This is not a question that all young officers should be asked to make some kind of studies or discoveries. However, today the armed forces do not have any positions or functional duties of an officer, wherever he may be serving, unrelated to the need for time studies, technical solutions, improvements of equipment, further developments, and so on....

Officer Andreev: I would like to draw your attention to problems which are particularly topical today. One of them is the accelerated updating of the

existing pool of combat equipment and armaments. For example, if we compare a modern tank before and after updating we can see that the combat efficiency of the updated tank has not increased somewhat but has multiplied, i.e., that the results are strategic. Such a tank, however, must be mastered, for it includes new systems which require higher crew training which, in turn, creates problems of a psychological nature.

The problem of the accelerated application of various developments in the armed forces must be reconsidered as well. It is no secret that in recent years our scientific potential increased greatly. We have the possibility of resolving a number of army problems and if we were properly to formulate them as basic assignments, the achievements of scientific and technical progress could have been applied even faster. The army urgently needed a specific instrument. The instrument was created and was rated highly. Some comrades, however, do not use it in the best possible way.

Every commander today must know what is being developed in his area throughout the world, what has been applied by the enemy and what are the possibilities of a given type of equipment or weapon, as well as the means to counter them. Consequently, the scientific and technical knowledge of the officer has become a mandatory component of his training.

Today the training of the troops in mastering new equipment and armaments creates many difficult problems which require no talk but the type of intensification of the training and utilization of training facilities which would ensure that in terms of difficulty and stress exercises are much superior to standard combat. We cannot compromise with the training of a tank man, a flier or any other specialist!

The use of systematized control systems also triggers interesting problems related to the personality of the soldier. We recently inspected a unit. The personnel on duty at the command post was sitting behind the automated control panel for the vehicle pool service. He was a modest person, with oil-stained clothes. He was tired. But that is not the problem. I was astounded by his views on combat readiness. He was not only aware of his responsibilities and of the vehicles in the pool but as a great commander he was considering the actions of the people and the equipment should the alarm be sounded. He could imagine and depict an entire model for action by the unit. This is not astounding, for an increasing number of military personnel are beginning to think in the same manner, for standing behind a complex system, the person will either think and act in a new way or leave. Such are the qualitatively new requirements which the new equipment presents to the person, forcing him to jump years ahead in his development....

Our army numbers dozens of talented young officers who have made the type of significant contributions which would make proud any army in the world. This is a tremendous national wealth. However, these young innovators must be enhanced. Conditions must be provided so that they may develop and further develop their talent and apply it. They need comprehensive moral support on the part of commanders, political workers and party and Komsomol organizations. Some soldiers are graduates of various technical schools. They have

attended TNTM [Movement for Youth Technical and Scientific Creativity] clubs and now they are itching to get to work. However, since no such activities are part of the barracks, schedule they gradually lose what they learned and what could be efficiently utilized. Conversely, if we put a talented soldier wherever he could grow, he would lead others as well.

Officer Georgiev: I would like to add something to this. It is a question of experimenting with different developments. Nowhere in the plans of a number of units, repair enterprises, for example, do we find experimental activities, for the people have their production plan and not even a small group of innovators could be given an assignment other than making repairs. Here is an example: our industry produces items which can be used straight or with minor adjustments in resolving problems related to defense. Under the current situation such a requirement must be requested and it takes a long time to meet such a request. Or else, an item may have been developed without our knowledge, but the planning time has elapsed. Therefore, we bind our own hands with the help of such legal documents. In my view, a substantial reserve of available funds must exist to meet newly developed requirements, for some newly developed tasks may exceed those included in the plan.

Editors: Let us add to this that at the December conference Comrade Todor Zhivkov raised the question of the development of so-called "pulsating structures," which pertains precisely to this problem. If something new appears a group must be set up immediately to resolve a problem within a short time, after which such a "pulsating structure" is disbanded. This means, however, that the respective commander must be given greater autonomy.

It is true that some wonderful things are being done in some units and there is bold experimentation. However, this is, so to say, merely a "physical exercise." The time in which we live demands that such problems be legally formulated. Their material and financial support must be expanded and strengthened. Possibilities must be created for a more flexible utilization of decentralized funds.

Officer Bistrekov: Allow me to consider this problem from a slightly different viewpoint--mostly in terms of the automation of troop control and the work of staffs on different levels. This makes very important the BCP Central Committee Politburo resolution regarding the second computer literacy of young people. Since it is mostly young people who serve in the armed forces, this applies to us as well to the greatest extent.

Another very essential matter is that of the utilization of various methods in this respect. We read about the establishment of computer clubs. With the help of such and other means troop specialists, and not only them alone, could be exposed to electronics. This may apply also to the children of military personnel so that they may become involved with army problems from an early age. Generations of electronic specialists may be developed in the armed forces the way generations of metallurgical workers and other specialists are raised in the national economy.

It is very important to be able to be aware of scientific and technical achievements not only now but in the future as well, in order to direct the

training of specialists years ahead. Here as well I see the role which the newspaper can play by promptly reflecting all ideas and initiatives of army innovators.

Personally, I am concerned by the question of designing technical or program developments. Looking at the experience of some countries advanced in this area we would see that there the cycle takes 2 to 3 months.

Lieutenant General Molkhov: Such is the case in some of our institutes as well. Occasionally, this cycle takes not months but 1 or more years. After the development has been completed, it becomes clear that it will be morally obsolete and that its application becomes senseless. Our entire discussion here has, metaphorically speaking, two red threads running through it: revolutionary thinking and revolutionary action. They should parallel any one of our initiatives. It is true that a number of questions and problems today can be resolved traditionally, i.e., as they have been frequently resolved in the past. One can see a method and a prototype, one becomes interested in previous solutions, and one begins work. Today this is entirely inadequate. When we speak of the development of new equipment. We must have in mind an entirely different scope of thought and action.

A very important problem is that of information support. It was believed in the past that this applies exclusively to scientific personnel and institutes, thus enabling them to submit new ideas and developments. This view is now obsolete. Today information support should be the concern of commanders, staffs and unit officers.

Officer Andreev: Let me add something to this. We must consider this matter not in terms of ordinary information, education and knowledge but as an active effort in formulating overall assignments. The current situation is that instead of attacking their superiors with their suggestions are forced from above to seek and to apply. Is this not a lack of sensing what the current needs of the troops are?

Officer Bistrekov: I think that the way to improve the training material facilities can be shortened considerably by not waiting for the overall completion but instead introducing individual modules which could be tested immediately in the troops. This will yield an immediate feedback and the item will be improved while it is still under development.

Officer Tsvetkov: Army life is strictly and precisely regulated. It has its precise algorithm for the day, the week, the month and the year. Therefore, whenever we try to introduce something new and unforeseen, it clashes with the breakdown of the daily schedule. This means that something must be disturbed for the sake of something else. Here again we face the problem of legal substantiations.

Positive results have been achieved in our unit in updating existing equipment and armaments and use of scientific and technical progress. However, we are hindered by some instructions and orders, so that we cannot calmly work in this area. The question frequently comes to changing the design, to

further developments, etc. At this point, I would like to suggest that NARODNA ARMIYA to discuss more extensively suggestions and ideas which express the thoughts and wishes of combat unit personnel. The newspaper could start a new section for such materials. Views and suggestions sent to the newspaper could be discussed and studied by specialists and scientific workers and, depending on their effectiveness, put to practical use.

Every officer in our unit has its specific assignments. Anything else that is done is, somehow, incidental.

Means must be found to enhance the prestige of troops who know and can do. Their activities must be so organized that the application of scientific and technical achievements may be successful with reducing training successes.

Officer Georgiev: In my view, a major prerequisite for the successful development of the officers on different levels as technically knowledgeable people is their self-training. In this respect we must make the fullest possible use of available and newly published technical and scientific works and be aware of new developments in the country and throughout the world.

Lieutenant General Molkhov: We have discussed the main topics of our conversation. In conclusion, let me repeat that everything comes to our style and method of work. The contemporary stage in our development simply forces us to be innovators and creators. We must be people of action, efficient, daring and precise. I believe that this newspaper could reflect many of the problems and questions we discussed. This would include, for example, the pulsating structures and the most efficient utilization of scientific and technical potential, the social status of scientific and technical cadres and activeness.... Commanders and officers who seek means of implementing their innovative ideas should be honored and respected.

In the wake of this conversation, we must continue systematically to discuss problems of the application of scientific and technical achievements, describe leading experience and indicate new developments and their results. It is time not to reassert familiar truths but to see their actual dimensions and specific manifestations.

Suggestions

Work on the comprehensive technical and psychological training of cadres in successfully working with computers must be perfected;

The personal example of commanders, political workers and staff officers in the struggle for the application of the achievements of scientific and technical progress in the units must be enhanced;

The reputation of innovators, rationalizers and all personnel who decisively influence the application of NTP in army life demands a special attitude on the part of leading cadres;

The full utilization of the NTP under army conditions requires the faster application of scientific achievements and the fuller and more timely information of the personnel of the latest novelties in the development of technology and technical thinking;

Attention should be paid to the question of the feeling for new developments by leading army units. This requires a decisive removal of the traditional approach toward technology. Everyone must apply a new style and method of work and revolutionary thoughts and actions;

The implementation of scientific and technical achievements in the troops requires a considerable reduction of the length of the design-development-application cycle, based on considerations of the present and the future;

The question was raised at the meeting that a large number of new interesting and innovative ideas and suggestions are developed in the armed forces quite frequently, some of which are not utilized for a variety of reasons. The idea was expressed that this newspaper should publish such suggestions. That is why the editors will open their "Post Office Box: Innovative Ideas and Suggestions."

Dear readers, we await your suggestions which you may submit as descriptions, graphic presentations or assignments. For each one of them the editors will consult with the corresponding specialists and authorities and will make the necessary efforts for useful and interesting ones to be applied in army life.

We must acknowledge that the present stage in the development of military affairs is characterized above all by a drastic enhancement of the combat potential of armed forces and the efficiency of armaments and combat materiel. This is the direct result of the organic combination of science with military practice, the impact of scientific and technical progress and its influence on the overall life, training and upbringing of the troops. Such factors bring about substantial changes in the functional obligations and actions of personnel on all levels. They formulate strict requirements toward their professional, specialized, technical and tactical knowledge. That is why, in order to avoid lagging, the personnel must maintain ever more systematically and purposefully their training on the level of contemporary requirements. They must invest in them their overall activities, revolutionary thoughts and actions as demanded by the party's decisions.

The present discussion marks the opening of a new section on "Scientific and Technical Progress: Trends, Problems, Application," which is one of our basic initiatives dedicated to the forthcoming 13th BCP Congress.

Electronization Raises Combat Readiness

Sofia VOENNA TEKHNIKA in Bulgarian No 12, 1984 pp 1-3

[Article by Major General Engineer L. Georgiev, candidate of technical sciences]

[Text] The contemporary stage in the development of military affairs is characterized by a sharp increase in the combat potential of the armed forces and combat efficiency of weapons and military equipment, as a result of the organic combination of science with military practice. Whereas in industry science has become a powerful direct productive force, in military affairs it has become one of the basic factors and sources in enhancing and maintaining the combat readiness of the troops and the navy on the level of the political assignments set by the part. In this respect electronics plays an exceptional role as a booster of the pace of scientific and technical progress in all directions. The achievements of electronics are today being applied and utilized in literally all the cells of the complex army organism, in functional centers and, particularly, in weapon control and military equipment systems. It is the base of radar, communications and computers, automation, telemechanics, electro-acoustics, optical electronics, radio navigation and overall radio engineering support of aircraft flights, space technology, radio broadcasting, radio counteraction, etc. The achievements of electronics and the pace of its utilization and application in all realms of social life today largely determine advances in the political, economic, social and spiritual areas. On this subject, in his remarkable work "The 12th BCP Congress and the Further Development of Mature Socialism," Comrade Todor Zhivkov points out that "today we live in different times, a time when the scientific and technical revolution is developing extensively. It is under its influence that production forces are developing at a high pace in socialist and advanced capitalist countries. The development of science is triggering profound revolutionary changes in equipment and technology and in the economic, political, social and cultural development of society. That is why the party's program stipulates in capital letters that building the material and technical foundations for mature socialism means developing a base on the level of contemporary scientific and technical progress and the scientific and technical revolution.... That is the reason for which the resolutions of the 12th Party Congress consider comprehensive automation through the development of automated cybernetic systems in production and other social areas the prime and essential strategic task in the further building of the material and technical foundations for mature socialism....

"Electronics is the technical foundation of such systems today.... When we speak of electronics we bear in mind also the program support of material production and management, the development of the element base, and the use of microcomputers and microprocessors. To us all of this is related to the major task of intellectualizing all social activities."

The appearance of semiconductor instruments as discrete elements and, subsequently, of integrated microsystems and microprocessors was the reason for the mass dissemination and exceptionally dynamic development of computers as

the base for the scientific and technical revolution. The development of radio engineering and electronic equipment brought about radical changes in automation and the appearance of technical cybernetics, related to the theory, designing, production and utilization of complex automatic and semi-automatic control systems in industry and military affairs. A very close interconnection exists among radioelectronics, automation and technical cybernetics. Contemporary radioelectronic systems are so complex and resolve such important problems that their development and utilization are possible only with the use of the systemic approach and systemic equipment, which develop as a result of cybernetic progress.

The tempestuous development of radioelectronics as a whole and the tremendous opportunities which it provides for drastically upgrading the combat possibilities and efficiency not only of strategic weapons but of classical armaments as well are being efficiently used by the United States and its NATO allies in achieving military-technical superiority over the Soviet Union and the members of the Warsaw Pact. It is on this basis that they are developing and intensively applying in their armed forces high-precision weapons, reconnaissance-assault complexes and automated control systems in different army units, shifting the arms race to outer space, etc. According to the Western press, the cost of radioelectronic equipment mounted on contemporary aircraft and missiles is considerably higher than that of the carriers. It is precisely the achievements in the field of radioelectronics that are the base of revolution in military affairs and determine its development trends. The radioelectronic saturation of contemporary aircraft, ships, tanks, missile systems and complexes, antitank weapons, and means for reconnaissance and radio counteraction and communications facilities and complexes is so extensive, varied and complex as to be comparable to scientific laboratories. As a result of the exceptionally dynamic development of the element base in radioelectronics through the advancement of existing and development of new electronic instruments, the process of moral obsolescence of armament and technical systems and models and qualitative changes in their combat possibilities and operational features is accelerated. Contemporary radioelectronics is characterized by the utilization of a large number of radio systems different in terms of purpose, principle of action, complexity, cost, dimensions, weight, etc. What is meant by a radio system is a technical system the basic functions of which are performed with radioelectronic means. The basic components of the radio systems are radio transmitters, radio receivers and antenna-feeder systems, as well as computers, electric power, systems for graphic presentation of information, electronic sensors, control and operational systems, etc. Based on their information purpose, radio systems may be classified into systems for information transmission, information extraction, counteraction, retrieval, storage and data processing, combined radio systems, etc.

The physical phenomena on which the operation of radioelectronic instruments used in the radio systems is based are quite varied and number in the hundreds. Thus, for example, the emission and reception of radio waves is accomplished through an exceptionally wide range of antenna-feeder systems. Electric fluoresence is used in picture tubes and light diodes, while thermoelectronic emission is used in electronic bulbs. The interaction of

electrons with magnetic and electric fields is used in magnetrons. Acoustical electronic instruments are based on the interaction between an electron shaft and an acoustical wave. In semiconductor diodes, transistors and integral microcircuits, instruments with a charge connection, etc., the phenomena in semiconductors and metal-oxide-semiconductor (MOP) structures are used, whereas the total internal reflection in optical emanation is used in light conductors, etc. These examples indicate that the development of radioelectronics is most closely related to achievements in physics, chemistry and other sciences and scientific trends related to the development and production of radioelectronic elements. In turn, the achievements of radioelectronics, applied in other sciences, act as a powerful catalyst in their development.

The main trend in the development of radioelectronics under contemporary conditions is the microminiaturization based on the achievements of integrated microelectronics. Of late they have been so extensive as to become the reason for the latest revolution in radioelectronics. Microminiaturization results in significant economy of materials, energy, size and weight of radioelectronic facilities, which is particularly important in their utilization in the military area. According to the foreign press, if we take as a unit the cost of transportation of one gram of radioelectronic equipment by car, the cost would increase by a factor of 60 if transported by airplane, by a factor of 130 for portable equipment, by a factor of 4,500 by radio equipment aboard a missile and by a factor of 45,000 for space radio equipment. In a number of cases such as, for example, radio equipment installed in artillery shells, its weight makes the systems inertial and worsens the dynamic characteristics of movable targets, for which reason the purpose is to reduce it to a minimum. As we know, the mass of the body is proportional to the cube and the strength to the square of its linear dimensions. Consequently, the proportional lowering of the dimensions of the equipment to a certain limit increases the ratio of its strength to the mass. Furthermore, the use of integrated technologies significantly upgrades the reliability of radio systems, for the number of mechanical contacts among the individual elements, blocks and assemblies is reduced to a minimum. The more complex a system is, the stricter become requirements concerning the reliability of its individual elements. Lowering the number of mechanical contacts may upgrade the reliability of radioelectronic equipment by a factor of more than 20 as a result of the use of integrated circuits and electronic switches. In integrated technologies the number of necessary welds and technological operations in the production or repair of the equipment is reduced drastically. Locking the active and passive radioelectronic elements within a common body lowers the influence of external factors, above all temperature, humidity, pressure, and so on, thus not only upgrading their reliability but their stability as well. Digital information processing and transmission becomes much more convenient in integrated circuits, for they are considerably more stable and durable compared to analogue systems. Today a single crystal with a volume of less than 0.1 cubic centimeters may include a microprocessor which would contain tens of thousands of active elements and perform a variety of complex digital operations. Complex equipment of about 1 cubic meter in volume was used to perform the same operations 15-20 years ago. The greater the information flow in the radio systems becomes the greater are the

advantages of the utilization of digital methods in their transmission and processing. A significant increase in reliability and reduction in the weight and dimensions of radio equipment enables us to install on flight and space apparatus general-purpose computers with highly stable frequency and time standards, which brings about qualitative changes in the possibilities of piloting and navigation sets used in performing a variety of tasks.

The creation and organization of the mass production of microprocessors, which include one or several large integrated circuits, triggered a real revolution in computer equipment. The essential feature of microprocessors is their possibility of resolving a great variety of complex problems. The algorithm of action of the microprocessor is determined not by its structure or internal system but by its programming. By changing programs, the same microprocessor can resolve a great variety of different problems with a different algorithm. Because of such possibilities, higher reliability and relatively low cost, microprocessors are beginning to be used ever more extensively in general-purpose and specialized computers and many other systems for controlling various types of military hardware. They are particularly effectively applied in coding, decoding and special data processing and in controlling radio transmitting and receiving systems in ground and on board radioelectronic complexes and systems.

Personal computers have become increasingly popular in various areas of management, production and the national economy in recent years. They are microcomputers with extensive possibilities, which could be used by people who are not particularly highly trained in this area, such as managers, physicians, engineers, researchers, etc., who are thus provided with invaluable assistance. Personal computers can resolve a broad range of problems within the system of combat training activities, in the selection of specialists who must meet stricter psychophysical requirements, as highly efficient simulators, in optimizing planning and various administrative problems, etc.

As we know, our country has a powerful research and production base in the area of radioelectronics, including computers and communications equipment, flexible automated production systems (GAPS), minicomputers, personal computers, an entire range of memory systems, data transmission equipment and general-purpose and specialized computers. With many such items Bulgaria is actively participating in the international division of labor within CEMA.

The process of applying electronics in the material and technical base of the armed forces and the training process and the intensive application of automated control systems in troop and weaponry control also creates a number of problems. The main problems are related to the training of the personnel in the combat utilization of radioelectronic means and complexes with maximal efficiency, including control systems. Thus, for example, the application and utilization of automated workplaces (ARM) as part of the ASU [automated control systems] complex changes the functional obligations and actions of operators. They must display greater specialized and tactical knowledge. The use of ASU radically changes the activities of the commander who organizes the battle. Difficulties on the purely psychological level appear as

well. Some officers display quite convincingly their high efficiency in combat control with the use of ASU. In practical terms, however, they are not always able to prove this. The use of electronics in the armed forces raises a number of high and qualitatively new requirements in the professional training of the officer corps on all levels. There can be no question of the efficient utilization of ASU in tactical units, for example, without mastery of the basic principles governing their combat utilization by officers of more senior grade and higher staffs, who must not only control but assist in their application. The intensive development of radioelectronics results in the fast moral obsolescence of knowledge in this area. In order not to fall behind, the personnel must systematically and purposefully maintain its training on the level of contemporary requirements in all units without exception.

The extensive utilization and application of radioelectronics in army practices has already converted it into a tremendous universal force in enhancing the level of the combat potential and readiness and upgrading the efficiency of the training process and military-scientific and scientific and technical research. Regular electronic training is assuming an increasingly broad place in the theoretical arsenal and professional skills of the entire officer corps regardless of military specialty. Such training is one of the important criteria in assessing the professional competence of the officer under the conditions of the revolution in military affairs in the time in which we live as we carry out the responsible assignments set by the party.

5003
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BULGARIA

SOVIET SCIENTIST DWELLS ON COMPUTER DEVELOPMENT IN USSR

Sofia RABOTNICHESKO DELO in Bulgarian 11 Jan 85 p 4

[Article by academician Evgeniy Velikhov, deputy chairman of the USSR Academy of Sciences: "On the Way to New Computers"]

[Text] One of the most important tasks defined in the resolution of the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers of the USSR on accelerating scientific-technical progress in the national economy of the Soviet Union is intensive development of research in the area of computer technology. The main role in resolving this problem naturally belongs to the research centers of the USSR Academy of Sciences.

At a general meeting of the USSR Academy of Sciences in 1983, a new section of the academy was created to deal with information science, computer technology, and automation. The new section will depend on the institutes which have traditionally determined the development of computer technology in the USSR; these are the M. V. Keldish Computer Center and Institute for Applied Mathematics, the Leningrad Scientific Research Center, and the Institute for Information Transmission Problems, where much experience has been gathered in the solution of major problems. Together with the directive about organizing the section, a resolution was made to designate a number of institutes as its basic ones, such as the Institute for Cybernetic Problems, the Institute for Problems in Microelectronic Technology and Super-Pure Materials with a Special Construction-Technological Office and Experienced Production. An Institute for Microelectronics and Construction Office were organized.

The section's basic research aims are first of all to develop the new technology. Computer technology is now facing an acute problem in the creation of computers with super-high productivity (super computers). It must be said that at the Institute for Cybernetic Problems at the USSR Academy of Sciences, at the Siberian section of the USSR Academy of Sciences,where a joint center for computer technology has been organized, and at the M. V. Glushkov Institute for Cybernetics at the Ukrainian Academy of Sciences, in close cooperation with the Ministry for the Electronics Industry and the Ministry of the Radio Industry in the USSR, work has been completed on the creation of several blueprints for super computers.

The creation of super computers is a large-scale problem. Not only must a new element base be developed of matrices of super-large integrated circuits, the construction of the whole machine itself must come into being. An even more complex problem, however, is developing the mathematical software for the computer in a timely way for mass use. These super computers are extremely necessary for solving major scientific problems, the automation of design, carrying out complex technical calculations, building ecological, climatic, economic models, etc.

The Institute for Information Science Problems has the task of developing the architecture and the mathematical software for computers for mass use. These are mainly small computers with high productivity, which are used in scientific research, for automation of design, and the creation of flexible automated production lines. Another direction for the institute is the development of microcomputers and minicomputers, as well as local networks. And one more important problem is developing the so-called personal computers. At first glance, this task seems not to be totally academic, but the work is there, and a new, universal, mass electronic computer must be created. Personal computers are now used by university and high school students for studying, in engineering elaborations, scientific research, business, and in the development of programs for the computers. And since we are already talking about mass production, we must be concerned not only about doing a good job of building the machine, but also about creating reliable mathematical software, which will allow it to serve people who are not acquainted with programming.

Three directions are being intensively developed at the Scientific Institute for the Complex Problems of Cybernetics at the Academy of Sciences, which has the right to a scientific research institute, and three corresponding centers are being created.

Physicists and theoreticians will work at the first one. This center will work in cooperation with the L. D. Landau Institute for Theoretical Physics.

The second center is linked to the Ministry of the Radio Industry, the Ministry for the Industry of the Mass Media, and the Ministry for the Electronics Industry. Its task is to create, together with the corresponding institutes, an automated system for designing very large integrated circuits. It must be said that the systems for automated design that now exist are not broadly used at a number of institutes. But the ones we have are not suitable for building very large integrated circuits, which are necessary for creating the next generation of computers. We must develop a system with a greater software capacity, which can handle modeling, testing, and dialogic processing of information.

And finally the third center, which consists of Moscow State University and the I. A. Likhachov Automobile Factory, is occupied with the problems of automating design in the area of machine building. Some success has been achieved in this area, too; a powerful automated system for design has been created.

Another group of academic institutes must secure the basis for the following step in the development of computers: the creation of a new generation of

microelectronic devices, in which mostly new physical effects and new technological processes will be used. This group includes the Leningrad Physical-Technical Institute, the Institute for Radio Technology and Electronics, the Institute for General Physics, the Physics Institute, the Crystallography Institute, and a number of others. They are not part of the new section, but they are closely linked with it, and a corresponding commission has been created to coordinate its work. The newly created Institute for Problems of the Technology of Microelectronics and Super-Pure Materials and the Institute for Microelectronics are included in the same group.

At the section's institutes they have also developed a large program for scientific research on new architecture for the machines, for developing self-paced study, and on adapted computers. A number of other directions in research are also being developed.

And finally, the questions of education in the area of computer technology are closely linked with the problems outlined above. Efforts are now being made in the industrially developed nations to liquidate computer illiteracy. Much work has also been done in the Soviet Union in this regard. The Siberian section of the Academy of Sciences and the Academy of Pedagogical Sciences are actively conducting the necessary research.

The rate of research on the framework of the tasks posited by the newly created section of the USSR Academy of Sciences is increasing quickly.

[Editorial statement] This article furnished by the Novosti Press Agency.

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BULGARIA

LACK OF FOREIGN LANGUAGE KNOWLEDGE HINDERS SCIENTISTS

Sofia RABOTNICHESKO DELO in Bulgarian 11 Jan 85 p 4

[Article by scientific associate Aleko Novakov: "A Significant Reserve"]

[Text] It is hardly necessary to demonstrate that it is extremely important for each scientific worker, each specialist today to use the Russian language and at least one Western language actively. Being informed in a timely way about worldwide achievements in various fields of science, technology, and culture depends on this. And in addition, thousands of our scholars and specialists take part in the multitude of congresses, symposiums, conferences, and seminars organized in Bulgaria and abroad. There they support, by using a foreign language, not only their personal authority but also the prestige of their own science.

Experience and observations show, however, that a certain number of Bulgarian participants in these international professional meetings experience quite a bit of difficulty, that they do not always present their points of view sufficiently convincingly at the working sessions and discussions at roundtables because of ignorance of foreign languages. Often they do not manage to extract the necessary, useful scientific and other information from conversations behind the scenes or from personal meetings with foreign colleagues because of a failure to communicate freely in the respective working language or some other foreign language. In addition, those sent for short-term and long-term periods of specialization abroad sometimes, instead of devoting their efforts to deeper penetration of the essence of the problems they are working with, devote part of their time to attaining the necessary linguistic minimum (most often in their specialty), to linguistic acclimatization in the respective country. Thus because of language barriers, the scientific workers cannot always fully use foreign literature and printed editions, which we receive here.

Centers, schools, and lectureships have been put together in our country so that citizens can obtain necessary generalized or specialized language training. The specifics of a foreign language, however, require those who have mastered the knowledge systematically to maintain and constantly enrich it. There exist other courses at departments, institutes, enterprises, and reading halls, where instruction is carried out with various (sometimes insufficiently effective) methods and textbooks, at which those studying can receive foreign

language training in their specialty. Study there is not conducted in correspondence with the students' practical needs, and with scientifically based aims and precise criteria for evaluating the knowledge and skill. This is due to insufficient harmony between the various authorities, to the failure to find out about the needs of those studying.

All of this demonstrates the need for attentive, mutlifaceted discussion and competent resolution of the problem of high-level and high-quality foreign language training and preparation of the scientific (and not only scientific) cadres' potential in our nation. And this means a more efficient organization, more effective coordination between the Ministry of National Education, the Council for Higher Education, the State Committee for Scientific and Technical Progress, the Bulgarian Academy of Sciences, various ministries, committees, the Union of Scientific Workers, leading centers, schools, the Association of Teachers of Western Languages, etc. Perhaps it would be wise to put together a general competent organ, which would coordinate and direct the activities in the various post-graduate forms of language training for the scientific workers and specialists from various fields and directions in Sofia as well as large okrug centers.

Great reserves could be tapped by scientific research on the methodology and psychology of mastering foreign languages under intensive, semi-intensive, and extensive conditions, comparative studies, research on the particularities of scientific style, on oral communication in a foreign language, on a system of scientifically based criteria for checking the acquired knowledge and skill, the forms of maintaining the language after the course is finished. We have all the preconditions in our country for constructing a productive, comprehensive system for teaching adults who utilize the modern, progressive trends in foreign language teaching, as well as some of our original pedagogical approaches. This is an integrated approach, creatively adapted to the specifics of foreign language study. Along with its methodological and psychological advantages, attention is paid to the difficulties of mastering the respective foreign language which are characteristic for Bulgarians, the factors which they encounter and which hinder their adaptation to life abroad.

A high level of study in a foreign language, bringing it closer to everyday needs, requires the creation of a system for foreign language training of those with a higher education that is unified (in terms of formulations, principles, and requirements) and differentiated (in terms of goals, organization of the study process, and textbooks). Thus our great army of specialists will directly utilize worldwide achievements, will quickly and economically discover the necessary current information, will support even more authoritatively their conceptualizations and scientific results at international gatherings. This will have an effect that is not just limited and administrative, but it will have great national significance.

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BULGARIA

COOPERATION WITH USSR IN DEVELOPING COMPUTERS OUTLINED

Sofia RABOTNICHESKO DELO in Bulgarian 14 Jan 85 p 4

[Article by Mara Georgieva: "Cooperation Gives Rise to Responsibility"]

[Text] "Traditional, productive, and dynamic!" This is how the people at the Computer Technology Plant define, briefly but precisely, their ties and cooperation with Soviet institutes and trusts.

The tradition orginated more then 10 years ago, when the collective began production of the ES-2622 central processor. The work was done entirely based on Soviet plans, and the production was intended mainly for export to the Soviet Union.

The results of the cooperation continue as well with the following model of the processor, the ES-2635, and in the development of the disk systems traditional for the plant, based on storage devices of magnetic disks with various capacities.

The dynamism of the relationships between the Computer Technology Plan and the production trusts for computer technology in Minsk, in Kazan, and at the Brest Electromechanical Plant are characterized by rapid reorganization of production, depending on the trends in the development of computer technology, on the expansion of mutual exchange and of creative contacts.

These three assessments...determined the direction of my conversation with engineer Rumen Yamaliev. He is the head of the section for computing machines at the plant. My interlocutor added: "The forms of our joint cooperation are being developed. The exchange of information about the latest scientific-technical achievements, the study of experiments in the creation and testing of the items, the mutual visits of specialists, all accompany the work on licensing the paperwork and the joint developments."

The plant maintains traditional ties of cooperation with the Soviet Union in an area which has already become a tradition in our country.

The initiation of these relations began long before the regular production of the items, actually during the period of development, conducted by the

specialists from the Computer Technology Institute, or based on development and implementation at the plant. Refinement of the technical-economic indicators and joint, bilateral testing had the goal of items responding maximally to the requirements and principles of the unified system for electronic computing machines.

"For us it is vitally important to maintain and expand these contacts," the director, engineer Vladimir Botev, said. "With the development and enrichment of this cooperation, our plant also develops. I have in mind not only the economic rates, but also the prestige which we have won on the international market."

I learn from engineer Nikolay Pavlov, the leader of the young people's workers' collective, that the young people in his workshop, who work on tuning the small machines, guarantee the high quality of production for the Soviet Union. They produce new items here: disk subsystems for machines from the SM-5405 series. Their work is characterized by the highest marks for quality, which were awarded at the end of last year, and also by the fact that up to now there have been no claims made by Soviet customers:

"We promised to improve the reliability of the disk subsystems from 1,000 to 2,000 hours, and we fulfilled this promise. This is a result of a more precise relation to work, and also of the arrangement by which we export our product to the Soviet Union. And for us this means to our friends," says engineer Nikolay Pavlov.

After this talk turns to the fact that Nikolay himself has done his specialized training in computer technology in Kiev, and that he has many comrades and colleagues in the Soviet Union who think as he does. This is true for many in the plant, because the creative professional ties give rise to an understandable proximity between Bulgarian and Soviet specialists. This arises from the nature of the common tasks which have to be solved, and from the natural common predilections, interests, and that kindred feeling, which exists in the spiritual make-up of the Soviet and Bulgarian people.

"We send our production to the Soviet Union, which is guaranteed the quality. For us this is a question of positions already won and which must be defended," Svetla Tatarcheva interrupts categorically; she is the assistant director of the section for technical and quality control.

Testing has already been completed for the automated program design system for the IZOT-1027. The establishment of trade contacts is expected. Joint work is continuing on the development of numeric program control. A new direction in joint activity is also the development and implementation of a matrix processor with great productivity and high speed of computation.

All of these directions in present and future work add one more stroke to the general picture of the economic ties the plant has with the Soviet production trusts. These mutual relationships give rise to great responsibility: that only high quality items be shipped to the Soviet Union. This responsibility is contained in the words: "We work like this, as if we were working for ourselves. Only even better."

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CZECHOSLOVAKIA

CSSR COMPUTER TECHNOLOGY SELECTIONS

CSSR, Foreign Microprocessors

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 481-485

[Article by Eng Vladimir Budar and Eng Jiri Smutka, Office Machines fiduciary concern organization, Prague: "Microprocessor Systems"]

[Text] Introduction

We would like to present in this contribution an outline of microprocessor systems and microprocessor elements marketed by our producers and, further, an outline of the common busbars used in microcomputers.

It can be said in general that a microprocessor system consists of a microprocessor, auxiliary circuits, and memory circuits.

Microprocessor systems themselves can be divided into single-case--their capacity cannot be expanded and their representative is the MHB 8080 microprocessor--and sectional--represented by the 2-bit MH 3002 microprocessor section, whereby the individual sections can be combined into a multibit microprocessor.

Microprocessor support circuits provide auxiliary functions required for microprocessor operation, for example, time-pulse circuits, breaker circuits, interface circuits, timing circuits, etc.

Semiconductor memories form the working memory storage, or ROM memory for storage and retrieval of information.

Connection of the individual elements by means of a busbar forms the microprocessor system constituting the basis of a microcomputer.

Microprocessor Elements

Monopoly producers of semiconductor microelectronic elements in our country are the Tesla Roznov and Tesla Piestany concern enterprises.

Tesla Roznov is engaged in the production of bipolar elements by TTL, TTL-S, I^2L, I^3L technology which finds application in semiconductor memories, custom-designed circuits, microprocessors and their support circuits. Bipolar technology can be briefly characterized as a fast, cost-effective technology of lower density of integration. It is used wherever the decisive criterion is speed.

Tesla Piestany produces circuits on the basis of unipolar P-MOS, N-MOS, C-MOS technologies with aluminum and silicon semiconductors (MOS--metal, oxide, silicon) differing from bipolar technologies by higher density of integration and lower speed. Thus, they find use wherever the primary consideration is maximum miniaturization of the final product.

Bipolar Semiconductor Memories

These circuits are coming to the market with a gradually increasing capacity of memory. Outputs of circuits are designed either with an open collector or as 3-state.

Access time to information ranges in bipolar memories between 40-70 ns, resulting in their use in fast microprocessor systems, e.g., the MH 3000 series, and also in systems of the MHB 8080 series. The technologies used for these memories are TTL and TTL-S.

Outline of Bipolar Memories in Production:

MH 7489 is a 64-bit RAM memory with 16x4 bit organization and outputs on open collectors. Circuit functions: storage of entries into memory, reading from memory, blocking of memory.

MH 74S201 is a 256-bit RAM memory with 256x1 bit organization.

MH 74S201E is a 3-state output. Circuit functions: storage of entries into memory, reading from memory, blocking of memory.

MH 82S11 is a 1,024 bit RAM memory with 1,024x1 bit organization.

MH 74188 is an electrically programmable 256 bit PROM memory with 32x8 bit organization and outputs with an open collector. Circuit functions after programming: reading from memory, blocking of memory.

MH 74S187 is a stencil-programmable 1,024 bit ROM constant memory with a 256x4 organization. Memory programming is done by the manufacturer directly during the production process made to customers' orders. Minimum order is 400 units.

MH 74S287 is an electrically programmable 1,024 bit PROM memory with 256x4 bit organization and 3-state outputs. The customer can order programming of the memories by the producer. This order must be accompanied by a table or a perforated tape specifying the contents. He can request the method for generation of the table or the perforated tape from the marketing department of Tesla Roznov.

MH 74S571 is an electrically programmable 2,048 bit PROM memory with 512x4 bit organization and 3-state outputs. Programming can be done by the producer.

Prospective Production of Memories (memory designation is merely informative)

MH 93425 is a 1,024 bit RAM memory with 1,024x1 organization.

MH 74S370 is a 2,048 bit capacity stencil-programmable ROM memory w/512x4 bit organization.

MHB 93448 and MCH 93448C are 4,000 bit capacity PROM memories with 512x8 matrix organization.

MH 93442 is a 4,096 bit capacity ROM memory.

MHB 93451 and MHC 93451C are 8 K bit capacity PROM memories with 1,024x8 bit organization.

MH 93464 is an 8 K bit ROM memory with 1,024x 8 bit organization.

Unipolar Semiconductor Memories

The use of MOS technology prolonged the access time to information on the order of hundreds of nanoseconds. However, the density of integration increased substantially at the same time. The internal structure of memory cells can be static or dynamic.

Outline of Unipolar Memories in Production

MHB 2500 is a common designation for a series of static ROM memories of 2,560 bit capacity. In the memory matrix is stored information about 64 alphanumeric symbols distributed into a 5x8 point raster. The memories can be used in organizations of 512 words x 5 bits or 256 words x 10 bits. Power feed is +5 V and -12 V.

MHB 2501 and MHB 2501A are generators of alphanumeric symbols in the Latin alphabet, code symbol ASCH (corresponds to CSN [Czechoslovak State Norm] 36 8802, CEMA RS 2175-69).

MHB 2502 is a generator of alphanumeric symbols in the Cyrillic alphabet, symbol code meets CEMA norm RS 2157-69.

MHB 1902 is a 1,024 bit static RAM memory, organization 1,024x1 bits, CMOS technology with silicon gate, 3-state output.

MHB 2102 is a 1,024 bit static RAM memory organized into 1,024x1 bit, NMOS technology, 3-state output, power feed +5 V.

MHB 2114 is a 4,096 bit static RAM memory, organization 1,024x4 bits, retrieval time 200 ns, power feed +5 V, NMOS technology with Si gate.

MHB 4116 is a 16,384 bit dynamic RAM memory organized into 16,384x1 bit. The rate or regeneration of information is 2 ms in 128 regeneration cycles, 3-stage output, power feed +5 V, -5 V, +12 V, NMOS technology with Si gate.

MHB 8708 is an 8 K bit EPROM memory organized into 1 K x 8 bits, NMOS technology with Si gate.

It is envisioned to introduce the following memories on the market:

MHB 2504-7 ROM, symbol generators for dot matrix printer.

MHB 6581 is a 256x4 bit static RAM memory, CMOS technology with Si gate, access time 350 ns, power feed +5 V, power input 0.1 W.

MHB 8111 is a 1,024 bit static RAM memory, organization 256x4 bits, NMOS technology.

MHB 2716 is a 16 K bit EPROM memory organized into 2 K x 8 bits, NMOS technology with Si gate, access time 350 ns, power feed +5 V.

The following table offers a comparison of selected semiconductor memories with their foreign equivalents.

[Table 1]

CSSR	USSR	Bulgaria	GDR	Hungary	Poland	USA
MH 7489	K 155RU2			TM 101	UCY 780101	SN 7489N
MH 74S287				TM 601		SN 74287
MHB 1902						SIL 1902A
MHB 2102	K 565RU2	CM 8102	U 202		MCY 7102	I 2102
MHB 4116	K 565RU3	CM 8116	U 256			MK 4116
MHB 8708	K 573RS1	CM 7880	U 555			I 2708
MH 74S201				TM 107		
MH 74S571						SN 74S571

MH 3000 Bipolar Microprocessor System

Developments in the area of bipolar technologies facilitated the transition to devising the fast MH 3000 microprocessor system using Schottky TTL technology. This system belongs among some of the most widely used microprocessor series. Basic programming is done by means of microinstructions.

The advantages offered by the MH 3000 series are:

--potential substitution of the supporting circuits of this bipolar system with the MHB 8080 system;

--potential for devising a fast bipolar microcomputer that could find application where MOS circuits cannot be used;

--orientation toward worldwide standard types, making possible familiarization with the hardware and software of these techniques ahead of time.

The MH 3000 sectional microprocessor system can be used in applications that call for high speed, variability and hardware optimization for the given problem areas, e.g., in development and design of fast control units for peripheral systems, programmable arithmetic units, sequential automated units, minicomputers, machinery control, etc. The speed of the system as a whole can be further increased by means of the MH 3003 accelerated transmission circuit connected to the field of sections. Design of a fast system based on the MH 3000 uses the control circuit of the MH 3001 microprogram, a field of 2-bit central MH 3002 processors and the microprogram memory.

Outline of MH 3000 Circuits Series:

MH 3001 is a microprocessor control circuit (MCU). It controls the sequence of reading of microinstructions from the microprogram memory. It includes an addressing control function, control state (indicative) functions, reading functions (LOAD), generation of interruption signal (ISE).

MH 3002 is a 2-bit central processor circuit (CPE) performing arithmetic, logic and register functions of a 2-bit wide section by a microprogrammable central processor. Devising a complete central processor unit with data word width of N bits calls for generating a field by connecting N/2 CPE circuits. The processor field thus generated performs the following functions: arithmetic with cofactor to 2, logic product, negation product, nonequivalence, incrementing and decrementing, shift left and right, bit testing and zero detection, generation of transmission for MH 3003, multiple data and address busbar.

MH 3003 is a circuit for accelerating transmission (LCG), facilitates fast anticipation of transmission via the complete 16-bit CPE series.

MH 3205 is a fast 1 of 8 binary decoder, signal transmission delay is low (maximum 18 ns) with a low load current (max. 0.25 mA).

MH 3212 is an 8-bit accumulator with 3-state outputs, with logic for circuit selection and control of the functional mode by an auxiliary flip-flop circuit for interruption of the central processor unit where it performs the functions of exciters, accumulators and multiplexes.

MH 3214 is a control circuit for 8 levels of priority interruption.

MH 3216 is a fast parallel 4-bit two-way noninverting exciter (receiver of busbar with 3-state outputs facilitating separation and excitation of the external microprocessor busbar system).

MH 3226 is a fast parallel two-way inverting exciter.

Outline of components of the MH 3000 series with similar foreign types

[Table 2]

TESLA	INTEL	SIGNETICS PHILIPS	SIEMENS	USSR
MH 3001	I 3001	N 3001	SAB 3001	K 589IK01
MH 3002	I 3002	N 3002	SAB 3002	K 589IK02
MH 3003	I 3003		SAB 3003	K 589IK03
MH 3205	I 3205, I 8205		SAB 3205P, SAB 8205P	
MH 3212	I 3212, I 8212		SAB 3212P, SAB 8212P	K 589IR12
MH 3214	I 3214, I 8214		SAB 3214P, SAB 8214P	K 589IK14
MH 3216	I 3216, I 8216		SAB 3216P, SAB 8216P	K 589AP16
MH 3226	I 3226, I 8226		SAB 3226P, SAB 8226P	K 589AP26

MHB 8080 Unipolar Microprocessor System

The MHB 8080 microprocessor system produced by Tesla Piestany is made by unipolar NMOS technology. The basis of the system is constituted by the 8-bit single-casing MHB 8080 microprocessor for which was generated a whole series of NMOS support circuits, and also by TTLS technology. Some of the support circuits are also with the MH 3000 series. They are the MH 3205, MH 3212, MH 3214, MH 3216 and MH 3226 circuits, which were characterized in the preceding chapter. Programming of the MHB 8080 is at the level of instructions which are 1-3 bit and are successively recorded from the memory and processed by the microprocessor. While the system as a whole is slower in comparison with the MH 3000 series, due to the employed NMOS technology with Si gate, it is less complicated to operate due to greater density of integration applied to NMOS elements. In the area of programming we can also proceed directly in instructions of the MHB 8080 set and not through microprogram, as is the case with the MH 3000 system.

Outline of domestic components of the 8080 series:

MHB 8080 is a single-casing 8-bit microprocessor.

MH 8224 is a clock and exciter circuit for the MHB 8080 microprocessor system.

MH 8228 is the control circuit for the system and exciter for the busbar generating all control signals required for direct connection of the input/output circuit, RAM, ROM memories with the CPU circuit of the MHB 8080 microprocessor system.

MHB 8251 is a programmable serial interface circuit (USART universal synchronous and asynchronous receiver/transmitter).

MHB 8255 is a programmable parallel interface circuit (PPI programmable peripheral interface).

Circuits of the MHB 8080 series and their foreign equivalents

[Table 3]

TESLA	INTEL	SIEMENS	USSR
MHB 8080	I 8080	SAB 8080	K 580 IK 80A
MH 8224	I 8224	SAB 8224	
MH 8228	I 8228	SAB 8228	
MHB 8251	I 8251	SAB 8251	K 580 IK 51
	I 8255	SAB 8253	K 580 IK 53
MHB 8255	I8255	SAB 8255	K 580 IK 55
	I 8257	SAB 8257	K 580 IK 57
	I 8259	SAB 8259	K 580 IK 59

RPP 16 S Computer

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Slovak No 4, 1984 pp 485-488

[Article by Eng M. Gavlik, Eng Z. Kostolny and Eng J. Vrana, Tesla Orava concern enterprise, Nizna: "Data Acquisition and Preprocessing on RPP 16 S Computer"]

[Text] The RPP 16 S computer was installed in Tesla Orava in Nizna in 1981 as part of introduction and implementation of the ASRP [computerized enterprise management system] with the objective of devising a system of data acquisition and preprocessing for the T 200 computer.

At the present time, after almost 2 years of operation, it is possible to assess the contribution made by the system for the enterprise, particularly from the viewpoint of the speed and accuracy of data processing. Data acquisition itself is made via a terminal display network which is connected to the RPP 16 S computer. The entire network uses the SM 7202 serial displays. Connection of serial displays to the RPP 16 S computer called for certain modifications in the computer's housing C, to which all the displays are connected.

The following are contained in housing C:

--DP 4 disks control unit 1 unit

--MPM/40 tapes control unit 1 unit

--BJM/S block of interface units 2 units

Each BJM/S casing contains 16 T 0360 plates, 2 T 0310 plates and 2 T 0311 plates. The T 0360 plate facilitates the connection of the SM 7202 serial display to the RPP 16 S computer and at the same time carries out the functions

ACU IN and ACU OUT. One display is connected to each plate. The BJM/S case itself can be made by modifying any BJM case from housing C. This modification is rather extensive, inasmuch the entire case must be rewrapped and a new tilting rear wall must be made to accommodate the 6AF 895 99 connectors for the connection of serial displays.

As the T 0360 plate contains the MHB 1012 (UART) circuit--which uses -12 V power feed--the same power feed must be provided for the BJM/S case. The -12 V feed voltage is obtained by modification of the all-purpose power source +5 V, -5 V, +12 V, which comes as standard equipment with housing C. The BJM/S case is connected by three cables directly to the BPK case in housing A of the computer. From the preceding it follows that connection of the network of serial displays to the RPP 16 S computer can be implemented through modification of standard parts of the computer and there is no need for any investments for the procurement of new systems. The display network in our enterprise currently includes 25 SM 7202 displays. The displays are distributed, for all practical purposes, throughout the entire premises of the enterprise, the farthest being approximately 1 km away from the computer. The entire network operates with a transmission speed of 4,800 Bd. The entire system is very reliable.

In view of the great amount of the information received and processed, it is impossible to operate with only four DP4 disk memories. After modification of the control unit for disk memories we connected to the control unit eight DP4 mechanisms, which all work during full operation. All the described modifications of the RPP 16 S computer system were made by domestic parts and proved to be fully viable.

A multiuser operating system is used for the acquisition and preprocessing of data, making it possible to process tasks according to 16 priorities. The terminals are divided by priority into three groups. The key criterion for this division is the importance and capacity of operations performed from the terminal. Users of terminals have the option of printing out the information shown on the display on a printer located next to the display.

The following data are collected and preprocessed in the enterprise by this system:

--information about turned-in production from all operational facilities, including remote facilities,

--about material received by the enterprise,

--about material received for storage after passing OTK [technical control departments],

--about all types of expenditures and transfers of material,

--about changes and supplements in basic sets:

--performance norms,

--parts catalogue,

--price list for procured materials,

--changes and supplements in basic personnel records,

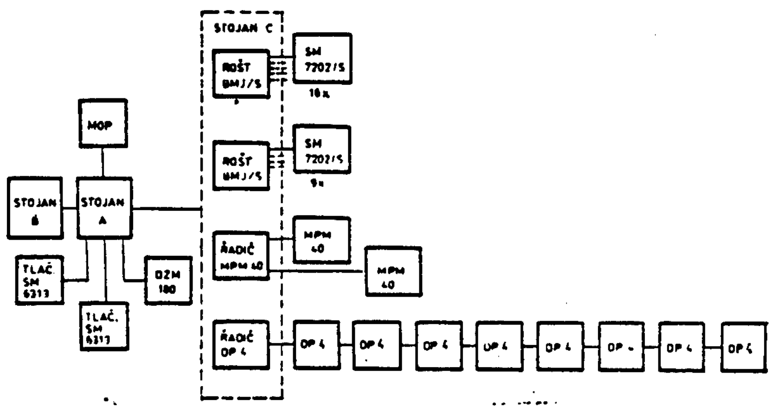
--changes in basic data,

--nonrecurrent items in wages, premiums and bonuses.

Data is checked during acquisition for correct syntax, extent, linkage to other sets. Only data that meet all the required criteria are recorded into sets and admitted for further processing.

Preprocessing of data includes sorting, totalling, assessment, etc. The data thus modified are then transferred via magnetic tape into the T 200 computer for further processing.

[Diagram]



Key: radic = control unit; rost = case; stojan = housing; tlac = printer

These data are then further processed by the RPP 16 S computer. The final product is an information system which offers the following capabilities:

--monitors in real time material received by the enterprise, its inventory in operational storage, issue to individual centers;

--monitors in real time availability of material for the enterprise and for the individual centers toward meeting the plan;

--monitors in real time turning in of production from individual centers and meeting of the plan by the centers;

--monitors the number of personnel in the enterprise and individual data about them;

--offers in real time information about the production plan and production norms;

--checks item by item the production turned in during the preceding months and, cummulatively, production turned in since the beginning of the calendar year, receipt and issue of material cummulatively also from the beginning of the calendar year;

--calculates the consumption of material for meeting the plan by specific deadlines, or differential consumption when the plan is changed;

--operationally deals with other extraordinary requirements.

Access to the information system is devised by means of a fast retrieval program so that the required information appears on the display immediately after input of the request.

The information obtained in data acquisition is recorded on a disk medium by individual sentences. Data processing is done in batches, i.e., data are read or recorded by reading, potentially by recording of entire tracks. In this manner it is possible to accelerate data processing to a considerable extent.

All tasks are processed by means of the JOBRPP parametric program. Each task must be described for this program in the prescribed manner: signals, unconditional jumps, decisionmaking blocks with potential jump in response to a random signal forewards or backwards, individual programs that must be started up, a message with which the given program is started up, comments printed out on the display. After start-up of a task the completion of individual programs is announced on the console, including the relevant result. On the display appears at the same time a comment informing the operator about the status of the task, and the operator has the option of permitting continuation of the task, repeating a random sequence in the task, leaving it out, or terminating processing.

All tasks are processed on the RPP 16 S computer by this JOBRPP parametric program. Programs started up within tasks are also parametric, making modification of processing of entire tasks very easy and expedient.

Tests were devised for the expedient elimination of breakdowns, which in the case of breakdown of some device, e.g., display, printer, tape, or disk, facilitate fast and precise pinpointing of the breakdown during the system's operation.

The tasks dealt with on the RPP 16 S computer fully cover two-shift operation. Data acquisition and work with the information system fully utilize the capacity of the eight disk units.

Other potential expanded use of the computer depends on extending operation to three shifts, or allocating time to users.

All applicational software is conceptually uniform, based on segmentation of programs and their modular structure, making solution of new tasks expedient and easy.

Technology From Higher Schools

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 488-489

[Text] Schools, chairs and institutes of technically oriented CSSR institutions of higher learning participate in R&D projects related to the development of electronics, computer technology and automation in our national economy. Let us mention at least some of the results they have achieved most recently.

The CVUT [Czech Institute of Technology] Computer Technology Institute developed the IK 80 M personal computer for instruction in basic programming and for scientific and technical calculations of medium difficulty. Its peripheries are a television receiver, a cassette tape recorder, a dot matrix printer, a perforated tape reader and the MDS 200 and 1200 modems for connection to a hierarchically higher computer. Its ROM memory is 8 to 17 KB, RAM has a 4 KB user and 1 KB systemic memory. Software is written in BASIC.

The CVUT School of Electrotechnical Engineering developed a stochastic generator for testing analog and digital circuits, for modeling random processes, checking instruments and measuring deterministic and stochastic signals. It also developed a logic analyzer for recording and displaying the chronological sequence of a binary signal (up to 16 bits). The chronological axis is formed by clock pulses. The device can find application in facilities dealing with digital technology. Laboratory Instruments Prague is readying for production a voltage calibrator that was also developed by this CVUT facility. It can be used at facilities requiring a programmable source of precise d.c. voltages.

The CVUT School of Mechanical Engineering developed the M 1 modular manipulator of 1 kg carrying capacity, three degrees of freedom, hydraulic drive and lifting speed of 0.5 m/s. It weights 60 kg. Its modular arrangement permits configuration variants and, consequently, improved adjustment to manipulation requirements in serial and mass production.

The SVST [Slovak Institute of Technology] School of Electrotechnical Engineering developed the Uniwatt measuring system for measurement of magnitudes in electric networks, and an instrument for measuring and sorting low-frequency transistors according to noise, an infrared sensor for robotics and automation, a data transmission system for nocommutated telephone lines up to transmission speeds of 12,200 bit/s, and a training microcomputer system for telecommunication diagnostics.

The SVST Bratislava School of Mechanical Engineering developed an all-purpose demonstrational modular system of electronic circuits for training in microelectronics, digital technology, microcomputers, computer technology devices and automated control systems. It is readied for production and distribution by the Training Aids enterprise in Banska Bystrica.

The SVST Bratislava School of Chemical Engineering developed an electronic device for simultaneous measurement of the thermal and velocity field in flowing liquids. It can also record local speed and temperature at 15 points in single- and multistage systems.

The SVST Bratislava Computer Technology Institute developed a graphical point output unit based on the Consul 2111 printer for various applications in the area of design. Printing speed is 900 positions per second. The modification concerns only its electronic parts, is very simple with little demand on time and material and preserves even the original alphanumeric print.

M3T 320 Desktop Computer

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 497-498

[Text] This new Czechoslovak product in the category of intelligent terminals was developed and is produced in the Metra Blansko concern enterprise. The basic unit of the M3T 320 terminal is intended for independent use or as part of the IT 20 system. The computer comes equipped with an expanded modular interpreter of the BASIC 20 language.

Key areas of Application:

A. Scientific and Technical Calculations

The BASIC interpreter is equipped with an adequate amount of functions for operation with digits with up to 12 lines accuracy and a mantissa of ±99.

B. Measuring and Control Systems

The M3T 320 hardware and software enables it to operate as a programmable control unit of metrological systems, particularly the IMS-2, CAMAC and DASIO.

C. Data Acquisition, Processing and Transmission

The M3T 320 hardware and software provides for operation of external intelligent and other than intelligent terminals, effective processing of acquired data and their storage on cassette tape memory, disk or cassette disk, or transmission of data to a JSEP [uniform system of electronic computers] or SMEP [system of small electronic computers] computer. Data transmission is provided by BSC routine, the program generates emulators of terminals, regarded as standards, facilitating off-line as well as on-line connection to a remote computer. With the aid of its own peripheral units it forms an effective decentralized data processing system.

System Description

The basic unit in the M3T 320.0 or M3T 320.1 variant (without built-in magnetic tape memory) is a desk-top computer formed by the processor, keyboard, display, cassette tape memory, power supply source, seven input/output positions, adapters and an indicator panel. These components are encased in a compact plastic housing. Electronic equipment of the processor and of other parts is based on modern semiconductor elements of CSSR or CEMA production.

The processor is formed by a 16-bit microcomputer built with microprocessor elements of the MH 3000 series, and the working memory storage is formed by

means of dynamic RAM memories and electrically programmable EPROM memories. The advantage offered by this concept is high processing speed.

The display comes equipped with a 31 cm diagonal television screen, and the employed symbols can be displayed in direct or inverse mode, also with underlining and in combination. Each symbol position on the screen is accessible through the program. The displayed symbols of the built-in display can be transmitted through outputs to a TV receiver or TV monitor.

The keyboard is intended primarily for contact with the programmer or operator. The keyboard field is divided into an alphanumeric field, editing keys, a digital field, functional field and a field of program-keyed keys. The built-in cassette tape memory is intended for recording and reading application programs in BASIC and ASSEMBLER. With the aid of this unit it is possible to store the data required for running programs. The power feed source of modern design provides all the voltages required for the operation of all terminals and of all connected adapters.

Adapters that can be inserted into up to seven positions of the input/output case make it possible to use the full addressing scale for peripheries, i.e., up to 16 independently addressable peripheries. Adapters designated M3T 323.x (where x = 1, 2, 3,...8 denotes the type of the connected periphery) and M3T 303.x (x = 9 or 11), together with the M3T 320 basic unit with the requisite software, form the IT 20 system.

Technical specifications:

--high-output fast 16-bit sectional microprocessor

--working memory storage RAM 64 kB, EPROM 64 kB

--built-in systems for contact with operator, keyboard, display, cassette tape memory

--BASIC and ASSEMBLER programming languages

--capacity of the built-in display 24 lines x 80 symbols (1,920 symbols)

--displayed symbols and display mode: lower and upper case alphabet symbols, Cyrillic alphabet, symbol inversion, underlining, acoustic signal

--contactless keyboard: alphabetic, numeric, functional and programmable keys (a total of 118)

--connectable peripheries: DP [perforated tape] reader, DP perforator, printer, floppy disk, IMS-2, cassette disk, V-24, IRPS, etc.

--possible connection of TV monitors and TV receivers

--power feed: 220 V + 10 percent, operating temperature range +5 to +40 °C

--potential timed control of processors

--providing of graphic output

--portability

--ergonomic design.

Overall development will be concluded in the current year. The producer envisions meeting all the needs of domestic users from 1985 on, only a limited amount in 1984.

CSSR Computer Center Activities

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 505-506

[Text] South Moravian Crude Oil Fields in Hodonin assess exploratory wells with the aid of a computer. This makes it possible to assess the composition and properties of rocks deep in the earth more effectively and determine the presence of crude oil, natural gas, or mineral raw materials. Machine processing of data from logging measurements is nothing new in the enterprise. The computer processes each 25 cm of measured curves, while results were formerly obtained with the aid of a small desk calculator for layers ranging from 0.5 to 10 meters. The connected graphic system replaces the former manual conversion of curves into numerical data analyzed by mathematical methods. In comparison with the performance of a man who works with the data from a 2-kilometer deep well for approximately a week, modern systems can handle these data in a single day and, moreover, verify variants of potential calculation procedures. The new method also cuts down the number of pumping tests by as much as 30 percent. The computer center's personnel prepared a set of programs for assessment and verification of individual wells. The crews of Moravian Crude Oil Fields sink approximately 50 wells a year and the results from them are run through the computer, whereby the computer also checks by means of programs the state of wear of drilling equipment, cement-casing of wells, and compiles a geological record.

The Machine Tractor Station in Slany developed and produced its own microcomputer which it uses for control of large-capacity cow barns and pig sties. The devised program provides an instant and complete outline of all important data regarding the state of health of the farm animals. In addition to matrix data about births, the memory stores information about future reproduction (rutting season, insemination, duration of lactation, etc.). The microcomputer also records data about veterinary care, inoculations and health inspections. Zootechnicians are able to have all of this information displayed on the microcomputer's screen at any time or have it printed out.

JZD [unified agricultural cooperative] Drizen in Ceske Budejovice Okres is operating in cooperation with the Radiotechnical and Electronic Institute of the CSAV [Czechoslovak Academy of Sciences], Prague Food-project enterprise, and the district and regional agricultural administration in Ceske Budejovice

a system for individual dosage of high-grade fodder to milch cows. They have built to that end their own microcomputer from domestically produced parts. It is installed in the barn holding 2 rows of 60 restricted milch cows each at the Nakri farm. As early as several weeks later there was achieved a 12 percent saving of high-grade fodders and a 10 percent increase in utility. The signal for dispensing fodder from the dosage system is controlled by specific data reflecting the current utility of each milch cow, and all of the 120 animals can be fed in 25 minutes. The milch cows fast became used to the new system of feeding, and they show signs of the well-known Pavlov reflex: as soon as the dosage system is switched on they automatically wait at the trough. JZD Driten expects a return on its investment in the system in less that a year.

The VAKUS Communications Computer and Control Center in Prague is a fiduciary economic organization of the Central Directorate of Communications. It processes annually some 100 million postal money orders and for the city of Prague it handles payments for combined collections (regularly recurring payments for rent, electricity, gas, broadcast, television and telephone). It handles a quarter million such remittances by combined collection payees a month. It uses for that purpose a total of 13 automated computers the capacity of which is used to its maximum, as each operating hour costs Kcs 3,500. In addition to these tasks the center processes information for control needs in the communications sector in support of operational, planning and other activities. The good economic results achieved by this organization were considerably influenced by inventions and improvement suggestions which saved more than Kcs 1.5 million for the common good.

The IRISA production cooperative of disabled persons in Vsetin with 730 employees uses a Tesla JPR 12 computer, which relieves managerial personnel, foremen and others of administrative tasks. They devised a sophisticated system for piecemeal wages, including monitoring of time actually spent at work and meeting of performance standards; the distribution of materials is under systematic control, as is utilization of long-term production assets and many other activities that until recently were time consuming. It became possible to compile a program even for the area of production planning, which has its own specifics in view of the fact that 70 percent of the production cooperative's workers are disabled citizens.

In the Opava Union consumer cooperative they transferred to a SMEP computer the agenda of the plant physician, including the cardiovascular program. It keeps track of patients with high blood pressure, transplants, high-risk factors, inherited and acquired heart problems, etc. The set of information with 180 possible entries is stored on a disk which facilitates the storage of the required entries for 15,000 personnel. Processing is done weekly and consists of updating of data, automated selection of the number of persons to undergo an examination, and printout of invitations for them. The matrices are turned over to the physician, who enters into them any changes in the monitored data. Another result of this system are outlines of a statistical nature important to taking additional effective measures in the care of employees.

FRG Railways Information Service

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 507-508

[Article by Eng Jaromir Kloucek: "Electronic Information Service of German Federal State Railways"]

[Text] The information service of German federal state railways (DB) performs two basic but differing functions. The first is direct offering of information about transportation options to passengers directly at railroad stations, and the other is providing answers to telephone inquiries for passengers who request information service, e.g., for planning a trip. The DB telephone information service is currently subject to a great load and meets its tasks with great exertion of effort, and increasing its capacity would mean great expenditures in the area of investments.

For that reason DB is now planning a new EFA electronic system--a system of inquiries and answers regarding departures and arrivals of passenger trains. The system will make use of systems already installed on DB and supplemented by modern technological systems.

The first step toward the design of the EFA system was taken in 1981, when FIA automated information systems were installed at the main stations in Munich and Stuttgart. These systems offer information about the arrival of trains to individual platforms, other supplementary information is offered by uni- and bilateral tabular guides located at entrances and exits of platforms. The FIA control computer is directly connected to the computer of the dispatching center and receives from it information about all train movements. With the aid of the FIA computer, passengers are informed with a 20-minute lead in time about the platform and departure track of the required train and any possible deviations from the timetable of railroad transportation.

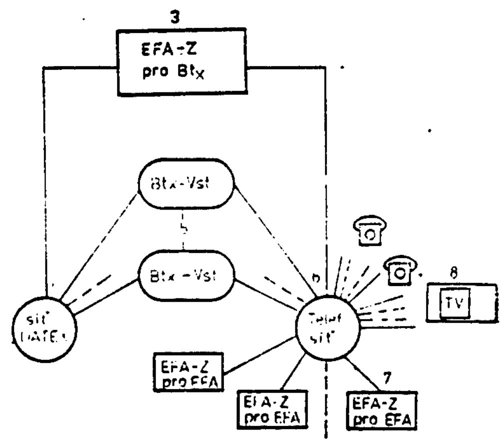
DB is currently not introducing additional information systems not controlled by computer. Display terminals are being introduced on a trial basis together with information tables in the FIA system. FIA culminates the passenger information process. The first phase of this process is the mentioned EFA system.

The economy of information systems depends primarily on the amount of expenditures for the acquisition of input information. The EFA system facilitates fast access to information in a dialogue mode and the capability of decentralized data processing in off-line mode. Build-up of the system makes provisions for its expansion in the future.

The concept for devising the EFA system is based on the organization and preparation of data, generation and protection of a data bank of train movements. The data bank reflecting the transportation situation, generated by a central computer (in a periodically recurring process with batch processing) is stored on external memory media, i.e., substitutable disks. The latter are always modified and updated prior to the introduction of a new timetable of railroad transportation in an off-line system. The EFA system consists of subsystems

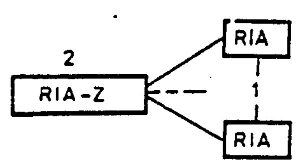
oriented toward automated information systems of specific railroad stations; these individual subsystems call for a varying extent of input information for their operation. This division is in keeping with the DB practice of generating for passengers both local and network information.

[Figure 1]



Key: pro = for; sit = network; Vst = input

[Figure 2]



The basis for implementation of such a concept is efficient processing of data about trains with the objective of their automated reprocessing into information about ongoing transportation without the participation of the human factor. That, however, will not be possible until the integrated system for processing of data about the timetable of railroad transportation (IFS) is implemented.

The EFA system is based on centralized data processing in connection with their decentralized processing in real time. The EFA structure is shown in Figure 1. The following EFA subsystems must operate in real time mode:

--station subsystems using RIA station automated information systems;

--local subsystems directly connected to public telephone network lines of the AFA automated information system;

--subsystems connected to public telephone lines, connected and integrated with the generated information system of the federal postal service, disseminating information to domestic Bf_x user displays.

RIA systems are autonomous; the link connecting them into the overall system are information subsystems that change with each change or modification of the railroad transportation timetable. AFA and Bf_x are connected to EFA centers (EFA-Z). The core of the system is a computer that processes data from the timetable of railroad transportation (train schedules) and provides for their distribution. Distribution of information to subscribers takes place in a dialogue mode. This, as regards software, is provided for by the corresponding program module of the central or auxiliary computer.

From economic viewpoints (EFA-Z) for AFA, EFA centers must be distributed in harmony with the structure of the country's telephone network. Territorial conurbations call for the establishment of several centers. The Bf_x system does not need a great number of EFA-Z. The German federal postal service is currently testing this system with active participation by the DB.

It is expected that the implementation of the EFA system will eliminate all the bottlenecks which previously deprived users of railroad transportation of being fully informed. Together with this automated system the traditional system of information for providing other indispensable and special services will also be maintained.

Data Transmission in Stribro

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 p 508

[Text] Early March saw the completion of the installation of a long-distance data transmission system of the Hungarian BUDAVOX company in the computer center using an EC 1033 computer of the user STS [telephone network administration] Tachov, Stribro computer center. It involves the EC 8410 data transmission multiplex, to which are connected programmable EC 8534 terminals by means of telephone connections and domestic modems. The data transmission system will be used primarily for remote access to the IDMS data base system.

JSEP 2, DOS-3 (DOS-4)

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 529-533

[Article by Eng Jan Sokol, Research Institute for Mathematical Machines fiduciary concern organization, Prague: "Operation of JSEP 2 Computers and the DOS-3 (DOS-4) Operating System"]

[Text] The replacement of older computers by computers of the uniform series JSEP 2 is currently under way. The objective of this article is to provide a brief outline of the new technical possibilities offered by these computers,

the new possibilities of operation constituted by them, and to show how these possibilities are reflected in the concept of the DOS-3 and the follow-up DOS-4 operating systems. These operating systems, developed in VUMS [Research Institute for Mathematical Machines] Prague for computers of the JSEP 2 series, are currently used not only with EC 1026 computers, but also with larger models of the series in the CSSR and GDR.

1. Hardware of JSEP 2 Computers

JSEP 2 computers are a continuation of the JSEP 1 series, with which they are compatible. From among the technical possibilities, of particular importance from the viewpoint of computer operation are the following:

--virtual memory,

--large-capacity disk memories,

--telecommunication and terminal devices.

Virtual memory is a set of technical means and programs permitting the flexible expansion of (addressable) working memory storage up to an (apparent) capacity of 16 M byte. If this possibility is systematically used in the operating system, it can handle flexibly and in a sophisticated way a number of problems: a variable number of simultaneously processed tasks, dynamic economization with memory, programming of very extensive tasks, providing access to a complicated data structure on a disk and others.

Large-capacity disks, currently with a capacity of 100 M byte and even higher in the near future, represent a great advance and, to a certain extent, a revolution in mass data processing. A fact of prime significance is that a large and increasingly greater part of status data can be made permanently directly accessible throughout the computer's operation. This forms the basis not only for data base techniques, but also for all methods of interactive processing in real time. However, if these possibilities are to be utilized, then computer operation must be planned and controlled by other principles than was the case in the past. With routinely used configurations of four to eight systems, it is not possible for each larger set or each group of routines to have its own disk bundle which is employed and removed according to need, as was the case with older computers. The latest types of disk memories with a capacity of up to 1,000 M byte absolutely do not permit substitution of disk packs--and it is not even necessary. Disk memories simply form a certain common available memory space which is accessible at any time and which is managed more or less automatically. Automatic location and allocation of space on a disk is in contemporary systems taken for granted, and it increases the significance of a catalogue of sets and of all means that centrally record and protect data sets and automate their processing. Since new disks are much faster, it is possible to use to a much greater extent non-sequential access methods (particularly index-sequential and data base), which goes a long way to make all processing considerably faster and more flexible.

Hardware for long-distance and interactive processing, i.e., transmission systems and terminals, brought about in advanced countries in the meantime the greatest revolution in computer application techniques. With JSEP 2 computers this great change is starting to take place on a wider scale in our country as well. The basic idea behind interactive processing is an endeavor to shorten the path from the "terminal" user of computer technology--be it a designer, an official, an accountant or a manager--to the computer and back. Thus, hardware must be supplemented by suitable software that will enable a user, though he is not a specialist in computer technology, to use their services directly and not only through programmers or computer center operators, as still is the case. For various types of applications it is possible to connect to JSEP 2 computers various types of terminal devices, from the simplest teletypewriters through displays to programmable intelligent terminals and minicomputers. It is also possible to set up networks of computers of the same or of varying types which mutually cooperate more or less closely. A certain practical limitation is still constituted by the low transmission speed and susceptibility to breakdown of telephone lines. Thus, it is advisable to connect (for the time being) the most commonly used display terminals, e.g., the EC 7920 series, locally to a multiplex channel.

2. Computer Center Operation

The focal point of the operation of data processing centers is, and for at least some time to come will remain, batch processing. The situation is analogous elsewhere in the world. That, however, does not mean that nothing has changed. Our enterprises have been generating for years a variety of extensive, often somewhat cumbersome application systems which, nevertheless, did on the whole play their role. Not only specialists in computer centers, but also those in other departments learned how to use them and it is to their credit that even in our country there are now many enterprises where a computer is not just a piece of expensive prestigious equipment, but actually serves a purpose. Thus, the first operational consideration in transition to a new technology will be to keep these systems operating at minimum cost. It will become possible to transfer most of it gradually in a way making it possible to make better use of the new possibilities, but there will also remain systems and programs that are not run very often and, thus, their transfer is not worth the cost and effort.

The ascendancy of JSEP 2 computers further underscores the importance of disk memories, which are not used merely as working memory storage, but permanently store basic data sets, minimally those for which some form of interactive processing is envisioned for the future. While disk memories are larger than was the case up to now, they are nevertheless still limited and space on the disk will still call for economic management. The initial impression that there is more than enough space available will last, as a rule, for a year at the longest; therefore it is better to proceed prudently from the very beginning. When the disks contain permanent sets of various users, from the viewpoint of operation it is then very important that the location, version and state of these sets be automatically reviewed and that it be possible to protect them against accidental as well as intentional destruction or, as the case may be, misuse. These functions should be met by a catalogue of sets, supplemented by

additional means for automation of operation. With the high performance and output of JSEP 2 computers and the currently routine complexity of processing it is no more possible to rely on the skill and assiduity of the operator and his delicate touch.

At the outset of batch processing it was assumed that data sets are an internal, almost a "private" affair of the individual routines used in operating with them. Programmers often talk of "their" sets, data, etc. Such a state of affairs will in continued development become a great obstacle, and many centers are endeavoring already today to introduce some sort of centralized recording not only of sets, but their contents, i.e., entry format, titles and contents of individual items, etc. We are of the opinion that this is a correct and indispensable first step toward integrated processing which every center should take before it starts to contemplate the use of data base resources in the true meaning of the word.

In relation to data base resources we nowadays often encounter exaggerated optimism, as if the data base were a panacea that will cure all ills, just as was the case with the computer 15 years ago and with ASR [computerized system of management] 10 years ago. In all of these cases the measure of optimism was in inverse ratio to the level of actual knowledge and experience. A sober look at things will show that a data base is a technical means for administration and processing of data that finds rightful application wherever conventional processing of sequential and index-sequential sets will not suffice. Secondary (though not unsubstantial) advantages offered by data base systems--particularly more flexible changes and centralized recording of data--can be also achieved by other means and at a much lesser cost. The key to success remains the problems of analysis and organization of data in an enterprise--hardware always plays only a supporting role.

To the increasing complexity of processing are added more linkages between the processing of individual subsystems or routines. This usually becomes manifested at the present time by increasingly complex regulations for operators (the so-called operograms). That is why many centers are on the lookout for means that would help automate this aspect of an operator's work at least to a certain extent. Comprehensive control of a "network" of tasks which are mutually interdependent are linked by various terms calling for complicated interlinkage in case of errors, and breakdowns will keep playing an increasingly greater role in data processing as well.

When important sets are permanently accessible on a disk, it becomes possible to make much greater use of nonsequential processing, particularly of index-sequential sets: sequential retrieval can be substituted by direct selection, often even without preliminary sorting. This step can also lead to a distinct improvement in the flexibility of processing and in the center's performance. If it becomes possible to introduce, e.g., Autoreport or some other simple generator of compilations, it will be possible to expedite short selective compilations (or rather "inquiries") at any time without long waiting periods. Insofar as "terminal users"--nonprogrammers--will themselves learn to formulate their inquiries in a form that can be handled by the machine language, the center will already be halfway toward interactive processing, even though it

may not have a single terminal. Experience shows that it is specifically this step--when terminal users overcome their fear of the computer--which is more difficult and takes longer than the actual introduction of hardware for interaction.

For this reason, it is usually the programmers who are first ready to use terminals and it stands to reason that most computer centers will start using terminals specifically for the generation, correction and tuning of programs. Since consumption of memory and of machine time, e.g., in editing, is not great, operations should be organized in a way making a computer available for these specific purposes at any time, not just during specifically allocated "tuning" periods.

The next step toward interactive processing is direct data acquisition with instant control. It can be introduced without any great changes in the organization of processing and does not represent any great load for the computer, so it can be handled throughout the entire shift in parallel with normal processing. While this method is less impressive than displays with luminous "menus" on the desks of managerial personnel, it is implemented much more simply and does away with the main reason why data processing shows to this day so little flexibility: the time consuming path through acquisition and verification of input data. It stands to reason that acquisition of this type calls for a commensurate number of terminals, but they can be terminals of the most inexpensive types (e.g., teletypewriters). What is of essence is the fact that the terminal user--storage manager, accountant, designer--immediately finds out where he made a mistake and, since he understands "his" data, can easily and reliably correct it. Processing of the data thus acquired can then proceed in the usual manner, but the processing step can be cut down to a fraction of the time usually required today.

Interactive data acquisition is naturally tied to terminal inquiry systems that can to a considerable extent replace periodical printing of formats. While they do not constitute any basic change in processing, they call--in addition to an adequate number of terminals--for direct access to the relevant status sets in the computer at least during certain hours. Once terminal users learn how to work with such a system, it will not only mean great savings of paper for printout of formats, but operational programmers will be absolved of frequent writing of single-purpose "inquiry" programs, which today consumes much time.

The ideal of direct processing of data sets that are continuously kept in updated state is for the time being inaccessible to most centers, not only due to lack of hardware and programmer capacity, but mainly for organizational reasons. It translates into substantial restructuring of all processing which cannot be accomplished from one day to another and which, besides, makes sense only for some processing systems. Where it does make sense, there is a need first to prepare conditions for introduction of simpler forms of interaction as discussed above. Transition to a new computer offers in this respect a good opportunity to reassess the existing system of processing and make well-thought-out preparations for a subsequent approach.

3. DOS-3 (DOS-4) Operating System

An operating system is a set of software controlling a computer's operation. Thus, the design of an operating system is always based on a concept of what a computer's operation will or should look like, and this concept then becomes reflected in the finished system in various ways. The DOS-3 [disk operating system 3] (and its continuation DOS-4) takes over from its predecessors DOS-1 and DOS-2 the assumption that the technical means, i.e., memory, processor time and, most of all, space available on the disk are limited and that they must be managed economically. But the actual concept of the system is considerably different, specifically with a view to more modern methods of computer operation.

Multiprogram operation with a variable number of simultaneously processed tasks is centrally planned and controlled more or less automatically, without manual intervention by an operator. Allocation of means is also centralized and dynamic, depending on what the tasks call for. It provides for indirect input and output of data with automatic buffering on the disk (SPOOL), disk and library sets can be shared among tasks, any required reservations are again automatic and dynamic. All partitions are equivalent and differ only by priorities.

The input and output system (LIOC) is programmed independently of the type of peripheral equipment, and the input of set parameters can occur only at the point of program start-up, or can be obtained automatically from data in the central catalogue of sets. Particular thoroughness went into the devising of the index-sequential access method, which is very fast and also permits operation with secondary indices.

The task control language has been considerably expanded, and comprises catalogued control procedures and conditional instructions. The system includes many translators of all common programming languages (ASSEMBLER, COBOL, full PL/I, FORTRAN IVH, AUTOREPORT and RPG II, PASCAL and many others), and a rich selection of service and auxiliary programs.

To ease transition from older systems it includes emulators of MOS systems (EC 1021), DOS-2 and, as of 1985, also OS. Emulation progresses concurrently with the processing of other tasks, neither the emulated program nor its control instructions need be changed in any way, even though they work with systems of a different type than those of the new computer.

No special operating sets need be generated for improved utilization of disk space--the system takes out the requisite space from them from a common reservoir which is also used for SPOOL and for pagination. In addition to basic information about a set, it is possible to store in the catalogue of sets also access passwords which protect the set against misuse or destruction. In the DOS-4 version this is supplemented by the System for Mapping of Logic Sentences (SMLV), which offers to the user of conventional sets a number of possibilities that were routinely available up to now only in data base systems: a centralized record of formats and fields in logic entries (sentences), automatic generation of description of a set into programs

written in various languages, and conversion of entries between their physical format on the medium ("scheme") and "subscheme," i.e., the subset of a scheme with which a certain program operates.

Two data base systems are currently available, the DBS-25 and (for Czechoslovak users) the IDMS. The simpler DBS-25 is based on the popular concepts IMS and/or DLI; the IDMS is richer and more encompassing, at the expense of greater demands on the system's resources. Functional possibilities for access to data are roughly equivalent.

The automation of task control is provided by parametrized control procedures, conditional and jump instructions and the newly developed system of console (terminal) "makers." A comprehensive system for controlling a network of tasks, based on many years of experience with complex batch processing, is being developed in cooperation with the GDR. The system's concept is suitable for the introduction of interactive (terminal) processing, and the system contains many components which support it. The basic telecommunication access method BTAM serves for the generation of specialized systems, the TAM access method is suited for programming terminal applications on various types of terminals. Every terminal can be connected to the system as an auxiliary console from which the programmer can operate and tune his tasks independently of all others, or as input of data and tasks into the system's lines (RJE).

The LUISA editor is used for the generation and correction of programs and for interactive data acquisition and can also serve as a simple means of inquiry, for nonprofessional users the IQF inquiry language is of particular advantage since it can also be used as a simple interactive generator of formats. Programming of interactive applications can be done in any programming language in which work with a terminal (or terminals) is done the same way as with a routine sequential set.

Among the substantial advantages offered by the system are simplicity of operation, fast introduction, and little demand on (residential) disk memory. The system operates in this configuration at approximately 100 installations in the CSSR and GDR on EC 1026, EC 1035, EC 1045 and EC 1055 computers. Its continued development is the subject of extensive efforts on the part of many collaborating institutions, particularly Office Machines, Computer Technology Enterprises, Datasystem, institutions of higher learning, and others. Of course, in order for the system to provide truly good service it is imperative to keep up active contact with its users, whose suggestions and comments are of immeasurable importance to its development.

SM 4-10 Computer Operation

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 534-340

[Article by Eng Zdenek Antos, Skoda concern enterprise, Plzen, Ostrov nad Ohre Plant: "Experience With Use of DOS RV 2 Operating System in Mass Data Processing on SM 4-10 Computer"]

[Text] The findings presented in this article are based on 2 years of experience with the application of the SM 4-10 computer in the sphere of mass data

processing. The SM 4-10 computer was installed in the Skoda Ostrov plant for dealing with temporary problems attendant to phasing out SPS and transition to a hierarchically higher processing of the plant management system by means of the EC 1026 computer.

The computer's configuration is as follows:

--128 K words (256 KB) ferritic working memory storage;

--common busbar, including expansion;

-- 4 IZOT disk units with 1 fixed and 1 exchangeable disk, i.e., 2x2.5 MB on 2 disk units, total 10 MB of memory on disks;

--2 IZOT magnetic tape units;

--1 high-speed line printer (300 lines per minute);

--1 perforated tape reader/puncher;

--1 VT 340 control terminal;

--2 EC 7202 terminals, including asynchronous adapters (ASAD);

--1 punch card reader.

The purchased configuration is supplemented by 2 EC 7202 terminals including ASAD's and an ARITMA desk-top punch card reader (DS). To the latter belong interface plates and a hardware decoder of 80-word punch cards. The interface plates were developed in Tesla Promes and decoder plates come from the Aritma plant.

As part of the plant management system's hardware, the computer is to cooperate with the SM 4-20, SM 3-10 computers and the main EC 1026 computer system.

The manufacturer provides the computer with the OS-RV operating system. Effective utilization of several minicomputers calls for the unification of basic software. It is envisioned to equip CSSR-made SMEP computers with the DOS RV 2. Components indispensable for mass data processing also come with the system. This involves specifically the SORT sorting program and RSZ--expanded entry processing--elements on which the SORT function is dependent. RSZ is also indispensable for utilization of the COBOL programming language. The stated reasons led us to use the DOS RV 2 system in lieu of the OS-RV system with the SM 4-10 computer.

We also envision the utilization of the DOS RV 2 system for the SM 3-10 computer in the so-called unmapped version designed for smaller ranges of working memory storage (32, 64 KB). In connection with expansion of the configuration of our computer by the DS reader, we had to deal with its integration into the DOS RV 2 operating system. We devised a special program unit for control of the reader. Its position in the operating system can be characterized as resembling a single-purpose (special) service (utility) program.

We use in operation with the SM 4-10 system within the DOS RV 2 operating system for data processing tasks the programming language FORTRAN IV plus. In comparison to the routine FORTRAN IV version, the FORTRAN IV plus modification provides the additional opportunity for operation with sets required in data processing tasks and implementing these operations by language instructions. The FORTRAN IV language implements only the most basic set operations (opening, definition) by means of subprograms from its library. FORTRAN IV plus also permits operation with integers stored in a range of two words (4 B).

Utilization of FORTRAN IV plus on the SM 4-10 computer called for installing within the operating system a software emulator of the so-called FPP (floating point processor). The FORTRAN IV plus translator designed for the SM 4-20 computer presupposes its hardware implementation, whereby the SM 4-10 computer uses for floating point operation only a set of instructions (FIS). The emulator then implements software FPP instructions by means of FIS instructions.

The reason we use the FORTRAN language for data processing is the fact that at the time when design operations began, the translator of the COBOL language was not ripe for operational use. That problem does not exist today. We envision the use of COBOL after we complete the currently ongoing integrated resolution of the relevant problems (which should be processed in one programming language) also because COBOL will be used with the main EC 1026 system.

In assessing the SM 4-10 computer system equipped with the DOS RV 2 operating system, the hardware and software component must be assessed in their mutual unity. It stands to reason that mass data processing is limited in routine configurations of SM 4-10 computers by the extent and structure of memory space on disks and on magnetic tapes.

By routine configuration we mean a computer equipped with 2x2.5 MB IZOT disk units and IZOT magnetic tapes. The use of magnetic disks in processing data sets is also complicated by the fact that one disk on the unit is always fixed. Equipping the SM 4-10 computer by only a single high-speed line printer is not fully adequate. Supplementing it by a DS reader is absolutely necessary.

In assessing the software component, i.e., the DOS RV 2 operating system in mass data processing, we can base it on the following prerequisites:

--The concept of the operating system is that of a multiprogram system for operation in real time in which multiprogramming is controlled by external events.

--It is intended for control and multiuser access (multiaccess) with tasks calling for smaller extent of external memories.

--The method for using the working memory storage, even though relatively extensive, small extent of memory space on disks, structure of sets, and the somewhat peripheral position of magnetic tapes meet the ultimate purpose of the operating system and are not in harmony with the requirements of mass data processing tasks

a) on the extent of external memories and the method for their operation,

b) on the machine time,

c) on the extent of the working memory storage for programs, particularly with the use of sequential sets (in COBOL only).

--The operating system's functional properties and characteristics will be hard put to meet the requirements of mass data processing, which is carried out mostly in batches, be it multi- or monoprogram.

--Implementation of multiprogramming during mass data processing in an effective manner will hardly be possible in view of the limited extent of memory space on disks.

I shall attempt to document these prerequisites by a more detailed analysis of the properties of the DOS RV 2 system operating on the SM 4-10 computer.

a) Operation With Sets

Operation with data sets in mass processing of data is limited by the purpose for which the operating system is intended. In control or multiuser mode operated in real time on a relatively small space of external memories, operation with data sets is not the prime mission of the system. Sets are used primarily in the preparation of the system's operation, when they are used to store program components with implementation of indirect sets of orders for operational control. Utilization of data sets is more or less peripheral.

The concept of the structure of sets and of the method for their processing is oriented toward meeting the requirements of operation in real time.

The system is not intended for the processing of extensive sets. In view of the addressing structure, the processing of multivolume sets cannot be implemented on magnetic disks. Multivolume sets can be processed on magnetic tapes. Magnetic tape units incorporated into the configuration of the SM 4-10 computer can process only small reels. A single reel can store the contents of approximately three magnetic disks.

However, for all practical purposes it is impossible to process sets exceeding the contents of one disk, e.g., the tape-to-tape method. The limiting factor here is the SORT sorting program. Difficulties are constituted by the fact that SORT calls for a great extent of disk memory for storage of its operational sets. Its only operating mode which makes it possible to sort more extensive sets calls for access from a magnetic disk, because it uses relative sets (RAF-files).

This, of course, makes sorting of multivolume sets impossible. Substitute variants for processing partial sets on a disk and their sorting complicates operation from the viewpoint of work-intensive operation, demand on external memories and on machine time.

The SORT program does not contain an independently selectable MERGE component that is usually found in all-purpose computers. Classification of sets must be solved by the user himself. From what was said about sets above and, further, from the fact that magnetic tapes are rather slow, it logically follows that the processing of sets should take place mostly on magnetic disks. Magnetic tapes should fulfill a support function and serve for the storage of security copies of sets, or as carriers for data to be transferred to another computer system. For example, in Škoda we devised the transmission of magnetic tape sets from the SM 4-10 computer to the ICL 1900 series computer, which works under the GEORGE operating system.

Allegations about the supportive function of magnetic tapes are confirmed by additional experiences that will be listed below.

If effective processing of sets is limited to magnetic disks and if we have at our disposal IZOT units with 2.5 MB capacity and the operating system can process single-volume disk sets, mass data processing will be faced with considerable limitations in capacity.

From a disk's total capacity of 4,800 blocks, approximately 4,700 blocks with 512 B each are available for storage of a single set. Let us assume that 100 blocks are needed for the storage of systemic data. Recording in storage on a disk can go over the block boundary and the memory space can be used on a continual basis. This cannot be done on a magnetic tape when it makes standard use of components of the operating system for support of the ANSI format. On a magnetic tape it is possible to store into a block only sentences which can be entered in their entirety. The remaining space--shorter than a sentence--is not used. Use of magnetic tape offers less advantage than use of a magnetic disk. In quantification of limitations for mass data processing, "tape-oriented" storage of sets must be taken into consideration. Magnetic tapes are used almost always, at least for the storage of reserve copies. When a set is transcribed from the tape onto a disk, it is stored on the latter the same way it was on the magnetic tape. The following relations apply to computations relevant to the use of magnetic tape and disk:

a) for magnetic tape:

$PV = INT\left(\frac{512}{DV}\right)$ number of sentences in a block

$DV = DI + 4$ DV...length of sentence stored by the system in B

DI...length of user part of sentence in B

in transcription from a magnetic tape onto a disk it is possible to store:

$CPV_1 = 4{,}700\ PV$ CPV_1...total number of sentences

b) for magnetic disk:

$$CPV_2 = \frac{4,700 \; . \; 512}{DV}$$

$CPV_1 = CPV_2$ when the length of block 512 B is the whole multiple of DV record length stored by the system. If that is not the case, $CPV_1 < CPV_2$.

From this it follows that routine configurations of the SM 4 computer (using 2.5 MB IZOT disks under the DOS RV 2 operating system which processes single-volume sets) can accommodate tasks or larger entities which do not include sets exceeding those specified below:

4,700	sentences	257	to	512	B	long
9,400	sentences	171	to	256	B	long
14,100	sentences	129	to	170	B	long
18,800	sentences	103	to	128	B	long
23,500	sentences	86	to	102	B	long
28,200	sentences	74	to	85	B	long
32,100	sentences	65	to	73	B	long, etc.

It is obvious that sentence length must be selected in the upper bracket of the range where utilization of space on the disk is maximal. Another problem is the selection of sentence length so as to facilitate storage of sets. One of the approaches we used is the generation of transient areas in a sentence for the storage of data which are not needed for the entire time of processing of a certain larger functional entity--a task, group of tasks, etc. Data are stored in this transient area at the point where needed and are kept in it only as long as absolutely necessary. Since exchange of information in transient areas requires the creation of prerequisites for it, processing of tasks becomes somewhat complicated.

We have no experience for the time being with index-sequential sets, because they are handled in COBOL, with which we do not operate at the moment. However, judging from the essence of the ISAM method, the number of sentences stored on one disk will be lower than is the case with sequential sets.

Let us now look at some other possibilities for processing sequential sets in FORTRAN IV plus, since practically all program components for mass data processing utilized by us use sequential sets.

The expandability of a set is provided by using the relevant keyword when opening a set. When faced with a shortage of space on external memories we resorted to expandability of sets as a means for dealing with the gradual expansion of an input set during the processed period, specifically the current month. A set destined for monthly processing is generated in approximately three to four steps. A combination of partial sets, generated in the individual steps, could lead to overloading of memory space. Expansion of an existing stored set saves memory space, but brings about other complications during processing. In failure of the program or of the computer system the whole generated set is lost. An important finding we made was that expanded sets cannot be used to perform the UPDATE function, i.e., replace a read

sentence by a sentence with new contents. Yet, this type of updating of a set would have been attractive for us when faced with shortage of memory space. The FORTRAN IV plus language uses support components of the operating system for the generation of the structural ANSI standard in operation with magnetic tape. No operations involving rewinding of magnetic tape are undertaken within the software support of the mentioned structure, i.e., reversal by one entry, and REWIND. This makes UPDATE of a set and/or return of a read sentence for re-entry impossible.

Magnetic tapes can be used for operation without software support, but only at ASSEMBLER level. While this leaves fairly ample leeway for influencing the generation of the block describing the set (file description block), consideration must be given on the other hand to the fact that it will not be possible to generate standard operating signals. Operation in ASSEMBLER and MACRO-ASSEMBLER in dealing with mass data processing tasks on a wider scale is less than feasible, particularly where there is emphasis on speed in implementation of the individual components.

One of the basic properties of the address structure of sets (which is suitable for the generation of program components and indirect order sets) in the DOS RV 2 operating system is the generation of new versions of sets during entry of a set of the same title. The contents of a set of the same title cannot be transcribed. Preceding versions must constantly be deleted, either by the systemic service program (PI), or by prescribing the deletion of a processed set during opening of the set within a program written in FORTRAN IV plus. The disadvantage posed by this method is that the set must be deleted prior to subsequent use and that the contents are not deleted until such use. If we make use of deletion, declared within the program, then changes made in processing a task bring about the necessity to interfere with already processed program units. Complications in operation with sets are also caused by fixed disk units.

b) Monitor

MONITOR (MCR) has no components for interfacing of media and sets with logic units. It is obvious that with a limited number of external memory units with exchangeable media this function loses some of its significance.

There is no provision for combining an actual set with a set defined within the program by means of an MCR instruction, i.e., an alternative of TLBL, DLBL instructions in operating systems of all-purpose computers. At the time of processing the set must have a title, allocated to it during its definition in the processing program. If the same program is to be used for more sets of various titles, then the systemic program must first change the title of the set in accordance with the title in the program and, eventually, after completion of processing by the systemic program rename the set with the original title. That complicates the processing of tasks.

The problems of MONITOR are connected with problems of the so-called indirect order sets (ICF-indirect command file) which facilitate automatic call-up of the requisite MCR instructions for the processing of tasks. This is a certain

parallel to runs known from the operating systems of all-purpose computers. In addition to MCR instructions themselves, these command sets include special instructions that endow them in some aspects with greater functional possibilities than is the case in the already mentioned runs. This is due to the demands of applications for which the DOS RV 2 system is intended. On the other hand, there is no possibility for parametrization which would be implemented during call-up of the command set run the same way as it can be implemented in the start-up of a run.

Parametrization must be implemented in a complicated way through selections made during the run. The moment and method for making a selection must be displayed for the operator on the control terminal's screen. Further, description of the selection must be entered in operator's documentation. This complicates both the command set and the operational documentation.

Communication between operator and the DOS RV 2 system depends on what the system is intended for. The system does not call for operation by the computer operator in the way which is routine during batch processing.

c) Treatment of Errors

When an error occurs in the processed program, the command set continues to operate. The EXECUTIVE level lacks the requisite mechanism usually found in SUPERVISOR's of operating systems of all-purpose computers. Treatment of errors does not meet the demands of mass data processing.

If the operator overlooks the occurrence of an error, the system continues to operate. This results in unnecessary losses of machine time, and detrimental consequences of a breakdown state can keep on magnifying. It can lead to unnecessary destruction of sets, etc., resulting in additional economic losses. In this context I would like to reiterate that it is advisable to have at one's disposal a printout of the processing protocol. If the dialogue between operator and the system is reflected merely on the display screen, the possibility of superfluous running of the computer during the occurrence of breakdown states increases and it is impossible to analyze the causes for occurrence of errors. To determine the cause for occurrence of a breakdown state, the erroneous processing must often be repeated.

Due to these reasons, inexperienced operation can result in considerable organizational difficulties and economic losses.

d) Printing of Extensive Compilations

The DOS RV 2 operating system lacks indirect printing, SPOOL, for extensive output compilations. However, there is a capability for entering the compilation for printout on a magnetic medium--disk or tape. The compilation thus arranged can then be transferred by the systemic program to the printer at a moment best suited to the requirements of the computer system operator. It is also possible to provide in a relatively simple way for set-up of a given page of print in the pictorial compilation set and start the printout from it. Printing from a selected page is indispensable for reasonable printout

repetition of extensive compilations during computer system breakdowns or damage to printing paper which is not always of adequate quality.

e) Protection Against Hardware Breakdowns

The concept of the DOS RV 2 operating system does not call for the use of check-point and restart. In routine configurations of the SM 4-10 system are ultimately not provided any hardware prerequisites for storage of repetition points. Mass data processing is demanding on time and repetition of the entire processing during hardware breakdowns brings about complications. If hardware reliability is relatively low, the adverse organizational and economic impacts can be considerable.

Partial measures during printout, which is very time consuming, were described in the preceding paragraph sub d. Another partial solution is the establishment of restarting points in command sets which, however, complicates the processing of the task, and thus the work of operators.

f) Other Functions of DOS RV 2 System

The program components for conversion and some other functions needed for data processing are incorporated into the DOS RV 2 operating system on a continuing basis. At the time when we started dealing with these problems they were not available and we had to deal with those problems in the programs themselves.

Conclusion:

Our experience is based primarily on dealing with a set of tasks processing at monthly intervals documentation for calculation of wages. The calculation itself is done in the enterprise's computer center. Various outlines are generated for the needs of our plant. The extent of a key set contained a maximum of 32,000 sentences.

Practically all of the units of the configuration's external memory are drawn upon in this processing. Back-up reserve in case of breakdown is provided by the additional SM 4-20 computer system.

In mass data processing on the SM 4-10 computer under the DOS RV 2 operating system the solver is faced with a whole series of problems. Limitations constituted by the small extent of external memories of the usual configurations and, further, use of the operating system in the area of batch processing, for which it was not designed, tend to complicate the overall concept of the processing of tasks, generation of programs and command sets for individual runs. The consequences then become adversely reflected in the operational area as well. The processing of tasks becomes complicated and demanding on operators.

Sets exceeding the extents mentioned herein cannot be processed. This limits to a considerable extent the repertoire of data processing tasks that can be handled.

GDR Dialogue Communication System

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 540-542

[Article by Eng E. Rudolph Robotron combine, GDR: "Interactive Operation With the DAKS Dialogue Communication Systems From Robotron Combine"]

[Text] The development of applicational software in the Robotron combine is oriented primarily toward the preparation of tools and software elements permitting expedient and effective handling of user problems.

The software prepared by the ZFT Robotron plant covers the following areas:

--data bank operating systems,

--communication systems (for data transmission and interaction),

--mathematical methods,

--technological resources,

--research systems.

A new development in this field is the DAKS dialogue communication system, which will be distributed as of the fourth quarter of 1984. With it Robotron is putting at the disposal of users a highly developed component for remote operation and access to data. DAKS is a subscriber system oriented toward individual transactions and intended for dialogue operation in a virtual operating system. It permits dialogue by means of all terminals supported by the OS/EC operating system. Their operation is possible in both local and remote variants.

DAKS monitors and controls parallel access by many users to the programs and data bases processed by them through a telecommunication network. The BSAM, ISAM, DAM and VSAM methods can be used in data bank generation.

Each application program is assigned a so-called transaction code by means of which the program is initiated from the terminal and made to run. The user can communicate with the program during processing, so that he is offered the capability of true dialogue operation. User programs run in the computer in multitasting with priority control. Dialogue during processing is possible mutually between terminals as well as between terminals and the master terminal. It is possible to feed into the computer at the same time additional programs, or provide for their branching. In addition, the user has at his disposal a number of DAKS instructions for controlling the progress of processing. Applicational programs can be written in PL/1 and in ASSEMBLER. Many aids are available to that end.

DAKS can be used to perform all operations involving retrieval, storage, and changing of data in short response times.

Dialogue generation is supported by various aids. Macroinstructions make it easy to generate applicational programs that can be formulated independently of the type and format of terminal.

Coordination and dynamic administration of all DAKS (user programs, data bases, lines, terminals) is taken care of by the relevant administrative routines. DAKS becomes adjusted to the load during processing, either independently or by instructions from the master terminal. Here the characteristic feature is the processing of user and of administrative programs within the common program extent.

DAKS is adjusted to the user's conditions by two-stage generation. During generation are formulated such general conditions as:

--data about access methods (QSAM, DAM, ISAM, VSAM) for control of data bases,

--data about employed programming languages (ASSEMBLER, PL/1),

--data about access methods (BTAM, TCAM) for control of terminals.

Instructions for each individual case of use are carried out only after generation in systemic tables of DAKS, e.g.:

--instructions about transaction codes and the relevant programs;

--names of application programs;

--information about terminals, control units and routes (addresses);

--information about data bases (name, length of blocks and sentences, length and connotation of keys).

After translation of DAKS system tables, their selection for specific use prior to continued operation in DAKS is undertaken. This provides for the requisite adjustment to the changing conditions of application.

In addition to short response time, the basic criteria for a modern data communication system are trouble-free operation over long periods of time as well as reaction during occurrence of errors. The protective functions of DAKS provide for high operational reliability by means of:

--definition of protected data bases and working memory storages which are brought into their initial state when a transaction is interrupted. This provides for physical integrity of data bases;

--use of synchronization points;

--recording of all activities of users, programs and DAKS components in LOG data bases, compilation of a dynamic and a systemic protocol. The dynamic protocol records all changes by individual transactions.

The systemic protocol does the same with a view to the functions of the entire DAKS.

DAKS is thus becoming a significant instrument for protection against unauthorized access to stored data, because it uses:

--initial and concluding procedures for protection against unauthorized use of a terminal,

--passwords to prevent unauthorized operation with data.

DAKS also includes a number of variants for restarts and regeneration of the system following breakdowns. Restarts can be carried out in the form of hot, cold, or emergency start-up.

DAKS does not permit cancellation of data as the result of simultaneous changes in the data of multiple users.

Potential Applications

DAKS can be used for the processing of extensive complexes of tasks in on-line mode, particularly as a communication system for scientific and technical information. Special opportunities are provided for improving the efficiency of operations in banks and insurance companies. It will also find viable application in the processing of orders and in operational control and planning of production in commerce and in industry.

Application Conditions

Hardware

Computers of medium or higher performance class (EC 1055, EC 1055M or other comparable computers) with over 1 M byte of internal memory, equipped for remote data processing.

DAKS supports Robotron EC 8564 display systems in remote variant and Robotron EC 7920 (EC 7921 as remote and EC 7922 as local variant) as well as the following peripheries:

--Robotron K 8914 terminal (EC 7925.M),

--A5130 small office computer (EC 8577),

--Robotron K 8931 all-purpose terminal (EC 8565),

--Robotron K 8924 bank terminal (variant EC 8565),

--T 51 S and T 51 W teletypes.

Software

OS/EC operating system from version 6. 1 M4 SVS with access methods BTAM, TCAM. DAKS operates with TCAM interface, allowing cooperation of DAKS with other users.

The requisite extent of internal memory depends to a considerable degree on the specific type of application. 200 K byte can serve as a rule of thumb.

Services Offered

As part of DAKS deliveries Robotron provides and/or offers:

--a tape with DAKS components and a demonstrative example,

--user documentation,

--warranty and substitution service,

--installation of programs,

--training and consultation,

--assistance during installation.

British Information Science

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 p 542

[Review by h: "Information Science in Politics" from 01-INFORMATIQUE No 791]

[Text] Political representatives of leading parties in Britain recognized early the effects of information science. Thus, laborites concluded an agreement with the Acorn company to equip their offices with BBC microcomputers. On the other hand, the conservatives prefer the Tycom Microframe systems, of which they ordered 200 units for their offices. One unit, including software, costs 4,000 to 5,000 pounds sterling. The systems are to enhance keeping records of membership and systematic conduct of correspondence with maximum automation.

Sperry Rand MAPPER

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 pp 543-544

[Article by Eng Ivan Malec and Miloslav Kuba: "Interactive System MAPPER"]

[Text] MAPPER is a programming tool that promotes the efficient generation of applicational programs, or a tool for "non-programmer" generation of algorithms for computers. Its designation is an abbreviation of the expanded English

title Maintaining Preparing Producing Executive Report. The producer declares it for trade policy reasons to be a system for processing data in real time, meaning that it supplies the system only as a unit with its computer system's hardware. Thus, it is a means by which the Sperry company wants to acquire a market. In essence, however, it is a programming product functionally equipped at the level of editors (i.e., software facilitating modification of data in lines and entire texts and, as far as programs are concerned, modification of instructions and of entire programs) and table generators at the same time. It facilitates communication between user and computer by visual aids--by moving the cursor along the display screen and entry of natural mathematical symbols, etc.--without knowledge of conventional programming languages. It does not call upon the direct "program" processor to be familiar with the syntax of a language, a variety of declarations, etc. It does not even require him to identify data.

The interactive system MAPPER uses integrated data storage organized along the lines of conventional filing systems. The largest unit is called a "modus," up to 256 of which are put by the system at the user's disposal. Each modus is further subdivided into up to 8 "types," each of which can accommodate up to 3,000 tables of 500 lines x 132 symbols. MAPPER design is based on the assumption that most user data bases can be expressed in tabular form. (Tree structures of the data bank correspond to branches of the table's column.) For this reason MAPPER expresses each user data base as a set of oversized tables in a file in which the user locates items by leafing through and scanning information--lines and columns--which he wants to analyze after displaying it on the screen and thus identifying it. Scanning of tables is done, on the one hand, by identification of a given table and, on the other hand, by leafing through it, i.e., specifying by how many lines up or down it is to be moved, by how many lines to the right, etc. To that end the first line of each table lists instructions through which the tables can be moved by placement of the cursor and entry of the requisite number.

Updating of data in selected tables is done:

--by actuating the instruction SOE UPDATE, i.e., a reserved key on a specially adapted terminal (insofar as this software is also tied to hardware),

--by placing the cursor at the beginning of an entry which is to be transcribed,

--by entry of new data.

A sentence which can be transcribed without any additional moving of the cursor is displayed on the screen in boldface type. This feature does not apply to all MAPPER systems.

It is possible, of course, to update entire lines and columns by calling up the table mock-up, actuating the instruction MATCH and entering the updating condition. The procedure in this case is analogous to performing selections and mathematical operations.

Performance of mathematical operations within the extent of the displayed tables is actuated for horizontal operations in lines by the instruction CAL, an abbreviation for the term "calculate," and for columnar operations by the instruction TOT, an abbreviation for the term "total."

In either case,

--the table mock-up is located,

--operation CAL or TOT is actuated by using the keyboard,

--columns are marked by letters of the alphabet by using the cursor,

--the formula of the operation to be performed is entered together with the requisite condition (including logic),

--instruction for performance is given by pushing the starter key.

MAPPER is intended for direct contact between user and computer. Familiarization with it is divided into two half-days of instruction and explanation and two half-days of practice at a terminal combined with processing and practice using a complex case. Thereafter the user can "program" such tasks as distribution of footwear from wholesale to retail outlets, etc., all by himself. Its use is effective in cases involving operation with large sets of data. It is obvious that it will be less effective in "programming" tasks from the area of control of processes, etc. For processing of statistical analyses it comes equipped with simplified "instructions" for expressing relationships in columnar, circular diagrams and histograms in one or more colors depending on the display screens and terminals with which the system is equipped.

The MAPPER system's standard equipment includes the following configuration of hardware:

--1 M byte internal memory with Motorola 68010 virtual microprocessor (the processor weighs 25 kg and consumes 220 W),

--up to 16 terminals with a mono- or polychromatic display,

--a dot printer with a speed of 400 symbols/second, i.e., 300 lines per minute,

--28.5 M byte disks and/or a high-speed magnetic tape.

The Sperry company currently has two systems at its disposal: MAPPER 5 and MAPPER 6. The first is oriented toward company standards, the other toward IBM standards, i.e., it is "IBM compatible."

On 24-30 October of the current year the Software Brno 84 exhibit will be held as part of the INVEX exposition in Brno. As MAPPER represents top software which shows new forms of programming, making this activity accessible to anyone and overall multiplies its productivity manyfold, efforts are under way to demonstrate this system at the exposition. If those efforts succeed, the Czechoslovak public will see such a system for the first time in practical application.

Automation of Apparel Production

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 1984 p 544

[Text] The MOSKVA Apparel Production enterprise in the USSR currently uses in trial operation a comprehensive automated system with two SM-4 minicomputers making use of the "SAPR-Raskladka" program for curvilinear cutting of textiles for the production of apparel of all sizes. Among other things, information about new modern apparel in digital form and in combinations for various sizes is fed into the memories of the SM-4 minicomputer systems. These then facilitate fast and flexible production of new modern apparel. The following are installed in the system's structure: PKGI semiautomatic coding of graphic information, SM-EPP-2 interactive graphic screen display with light pen, and AP-7251 problem-oriented complex for graphic design.

Use of the "SAPR-Raskladka" program cut down the original 3-7 days needed for curvilinear cutting of apparel components to 1-5 hours and the time needed for measuring of various sizes to 15-25 minutes. The described automation of apparel production in the MOSKVA enterprise is the first in the Soviet Union and, after conclusion of its trial operation, it will be introduced in additional Soviet enterprises for production of apparel.

8204
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ACUPUNCTURE IN CSSR

Bratislava SLOBODA in Slovak No 51-52, 1984 p 5

[Article by Dusan Kacani: "Acupuncture in Our Country"]

[Text] There are currently more than 200 physicians in Czechoslovakia with an interest in acupuncture. Since 1978 physicians can receive advanced training [in this area] and acupuncture centers will most likely be set up in the individual regional and even district health care institutions. There is already a Department of Acupuncture at the College of Medicine of the Regional Public Health Institute, headed by MUDr J. Smiral. They effectively treat from 40 to 50 patients a day at minimal cost. This is a refuge primarily for chronically ill patients, most of whom have been treated by other methods without satisfactory results. The patients come from the assigned region of the districts of Bratislava-vidiek, Galanta, Senica, Trencin, and Trnava, as well as patients hospitalized at one of the Medical College clinics. In particularly justified and urgent cases, the Department of Acupuncture provides special services to patients from other districts, on the basis of exceptions to the region system. These steel needles (once gold or silver), inserted at the active points, mean a return to health.

Recently MUDr J. Smirala said of the rediscovered acupuncture, among other things, that it "avoids procedures which might harm the organism, such as the use of foreign compounds or the gross impairment of any part of the organism. On the contrary, it attempts to mobilize the resistance of the body itself, to normalize, regulate and adjust its normal physiological functioning. It achieves this by acting on the nervous system and on the endocrine glands, which produce the highly effective compounds, the hormones, thus affecting energy and materials metabolism. In addition to raising the resistance, reactivity and performance of the body, acupuncture is also highly effective as an analgesic, antianaphylactic, anti-inflammatory or antispasmodic agent, etc.

"Acupuncture treatment may be used in suitable cases, but only after a precise diagnosis of the illness has been made. The many illnesses which improve upon acupuncture treatment include ailments of the head, lower back, spine and joints, a variety of neurological disorders such as neuroses, neuralgia of the trigeminal nerve, facial tics and spasms, paralysis of the facial nerves, etc., and certain vascular and allergic diseases, such as

asthma, urticaria, eczema, allergic rhinitis, migraines, and the like. Functional ailments include various forms of dyskinesia of the gall bladder and bile ducts, dyskinesia and other disturbances of the stomach and intestines, chronic problems following jaundice or stomach and intestinal operations, high blood pressure in stages 1 and 2 of the illness, angina pectoris (cardiac ailments with no specialized findings), the so-called sexual neuroses (frigidity in women and impotence in men), enuresis, climacteric problems, menstrual disturbances, certain disturbances of hearing, taste, and smell, etc. Acupuncture is often successful in treating muscle spasms and disturbances of mobility in patients following sudden vascular accidents and in children following cerebral palsy."

Acupuncture is more than 5,000 years old, but it has existed only a short time in Europe. We are rediscovering it and doing research on it. For many people acupuncture means a return to health. The one-time bamboo needles have been replaced by metal or electrical needles, or by magnetic fields and laser beams. Acupuncture is no longer a scientific curiosity, but it is not yet a fully appreciated, broadly used system of treatment. It does, however, show great promise of having a brilliant future.

9832
CSO: 2402/7

CZECHOSLOVAKIA

FUTURE OF GENETIC ENGINEERING REVIEWED

Prague TVORBA in Czech 19 Dec 84 p 14

[Interview with RNDr Stanislav Zadrazil, CSc, acting director of the Institute of Molecular Genetics of the Czechoslovak Academy of Sciences, by Marie Nadherova: "The Tasks, Scope, and Future of Biological Engineering"; date of interview not given]

[Text] [Question] Recently the phrase "biological engineering" has gained widespread popularity in the media. Leading economic officials and personnel in different areas of science use it in connection with modern production processes. At the same time, however, there are those who think that biological engineering processes are not and will never be a cureall for all the ills of modern civilization. Comrade doctor, you are involved with biological engineering on a daily basis. What is your opinion?

[Answer] First of all, let me explain the essence of biological engineering. As the words themselves indicate, such manufacturing processes make use of the functions and properties of various living systems, from microorganisms to eucaryotic cells, or cells with nuclei. One might also speak of the functional activity of individual isolated components of these organisms, for example, of their enzymes or genetic material. Biological manufacturing processes have been with us since the very origins of humankind, playing a significant role in providing us with the basic means of substinence. The production of our basic foodstuff, bread, has always been and still is dependent on biological engineering, as is that of our drinks, both alcoholic and nonalcoholic, of cheeses and other products of the dairy industry, etc.

Particularly since World War II, much work has been done on the development of biological engineering processes intended primarily for use in the industrial production of chemical and pharmaceutical products, amino acids, hormones, vaccines, antibodies and diagnostic drugs. These products can now be synthesized both by traditional methods and by modern biological engineering methods. Both methods make use of bacteria, yeasts, molds, actinomycetes and the like as industrial microorganisms, whose cells function as a small biological engineering plant which regenerates as the desired compounds are being produced and thus produces biomass in the process of self-reproduction.

[Question] Most likely this very property is one of the reasons why we expect biological engineering to solve certain fundamental problems facing humankind.

[Answer] The self-reproduction process is a major advantage of biological engineering, since it is relatively undemanding of energy and can use as its source of carbon and nitrogen such waste materials as molasses, whey, wood waste products, and the like. Biomass and the desired compounds can also be produced using waste products which could pollute the environment.

[Question] Let's look more closely now at modern biological engineering processes.

[Answer] In contrast to traditional methods, they utilize organisms in which the genetic material has been altered for a specific purpose, in other words, which contain gene combinations not found in nature but created in scientific laboratories by genetic engineering, one of the areas of gene manipulation. Genetic engineering, as a new area of the biological sciences, works with isolated molecules of genetic material (nucleic acids, in scientific terminology), splitting them, recombining them, and introducing them into a host organism with the aim of producing new information, the synthesis of a new product. It uses data from biochemistry, enzymology, bacterial genetics, cell biology and other branches [of biology] and is thus a typical interdisciplinary science.

[Question] Genetic engineering is popularly thought to be a field of interest to only a small group of trained specialists, existing behind closed laboratory doors and of no use to the common people. What is the actual state of affairs?

[Answer] We have already noted that while traditional methods of biological engineering use organisms obtained from the natural environment by selection and improvement, genetic engineering creates a new organism with the properties required of it. This is actually a rather difficult task, carried on behind the doors of scientific laboratories, but the results of such research are already available even for practical purposes, and these are by no means insignificant.

Genetic engineering is used in three ways. Most important is the use of the newly developed procedures in basic research to obtain theoretically new scientific knowledge. Another way in which it is used in practice is to design organisms, both microorganisms and individual eucaryotic cells, which synthesize required compounds in short supply, primarily proteins (including in particular hormones such as insulin, growth hormone and neurohormones), antibacterial and antiviral compounds, and regulatory compounds of the immune system, such as interferon, interleukin, monoclonal antibodies, etc. These and other compounds have already been synthesized through genetic engineering. In our institute, for example, we are working hard on such research into the production of the enzyme chymosin, which is the basic component of the rennet used in making cheese, of the neurohormone metencephalin, which regulates the sensation of pain, etc. A third directly related area is the symbiotic relationship between genetic engineering and the specialized industry which satisfies the material needs of genetic engineering research and of modern processes of biological engineering. This includes the manufacture of devices and equipment for scientific research and for utilizing its results.

[Question] Can you give us more specifics on interferon?

[Answer] Interferon, of which there are three basic types, is considered very promising in view of its antiviral and antitumor activity. When interferon was first discovered, and it was found that it could be manufactured using manipulated organisms, there were grand plans for gaining mastery over malignant growths. Research has since shown that what is needed is not only the production of large amounts of interferon, but also a great deal of clinical research to provide the answers to a number of questions, such as which type of interferon can be used safely against which type of viral infection or cancer. For the time being, it seems most useful and most promising for the treatment and possibly the prevention of certain viral diseases, such as herpes and influenza.

[Question] Comrade doctor, you mentioned another branch of genetic manipulation.

[Answer] This is cell engineering, which at present is based primarily on cell fusion, uniting the cell contents of two cells of different types, i.e., nonmalignant cancer cells, which assure the resulting hybrid continuous growth, and lymphocytes, which produce antibodies. The newly created hybrid organism is similar to a single-celled organism and can be treated like a microbial cell. It grows in vitro, although under far more complex conditions. At present, hybridoma technology has been perfected for practical use in the laboratory to produce the so-called monoclonal antibodies against a specific antigen, making possible a distinct improvement in medical diagnostics. A major goal, apart from obtaining diagnostic compounds, is to synthesize safe synthetic vaccines, a project to which genetic engineering is also contributing. Cells are being created which will manufacture a protein, an antigen found on the surface of an infectious viral particle, which initiates the defensive immunological process in an infected individual.

[Question] Humankind has great expectations of biological engineering in connection with solving worldwide problems such as ecological and economic crises and food shortages. Are the capabilities of biological engineering overestimated?

[Answer] Biological engineering has great capabilities and a promising future. It will probably become one of the significant factors in solving future problems of humankind, but let me stress the word "one." For example, biological engineering may help to solve certain ecological issues. It can and does reduce the [need for] production of natural insecticides, for example, the endotoxin contained in Baccilus thuringeinsis, and the use of chemical insecticides. The same is true for the use of synthetic nitrate fertilizers, which biological engineering processes can reduce. But we must better understand the relationships between the soil micro-organisms in order to induce them to make more complete utilization of atmospheric nitrogen and to elicit more effective cooperation with the crop so that it might use the assimilated atmospheric oxygen. This would contribute to improving the soil and our water resources, all of this, of course, under favorable economic circumstances. A related problem is that of providing enough food for the

population by the further use of biological engineering in agricultural and in the food industry. New plants are very promising in this respect; a hybrid between the tomato and the potato can already be cultivated.

In this connection I would like to mention the use of synthetic foodstuffs based on single-celled plants. These are generally bacterial cells or yeasts, which produce very large amounts of proteins for animal or human consumption. Such production methods have been in use for a long time, but there they are still considered to be not quite economical. In our country such methods are used for the production of fodder. Recently, our most modern pulp mill in Paskova began cultivating nutritional yeast on waste liquor from cellulose production.

[Question] What other possibilities does the use of biological engineering offer?

[Answer] In long-range terms, modern biological engineering processes should be able to create modified organisms specific for any given product. Let me explain: if we know how to create an organism which produces a hormone such as insulin or an enzyme such as cymosin, we should in the future also be able to create organisms which would produce products much more broadly applicable in other areas of the national economy, for example, eliminating all wastes through the creation of waste-free production cycles. This problem is to design these organisms and learn how to clone them, to prepare large quantities of them and to regulate their activity precisely.

[Question] There is some concern about gene manipulation and its results in connection with effects on the human organism.

[Answer] We are interested in effects on the human organism which would, for example, eliminate genetic defects and diseases. Genetic engineering is currently used, for example, to diagnose genetic defects. Genetic tests are used for the prenatal determination of fetal defects and to advise interruption of pregnancy. In animal breeding, embryo transplants are already common, and there are attempts being made to clone cattle and sheep.

[Question] More specifically, though, what are the possibilities for manipulating human genes?

[Answer] It is still too early to speak of human cloning, although this is possible in theory; just as farm animals can be cloned, human genes can be manipulated at the level of the embryonal cell. This does not mean, however, that it would be possible to clone an individual with precisely determined mental abilities, as these are also the result of upbringing and environmental effects, not only of genetic disposition. This is still in the realm of science fiction.

[Question] At a recent seminar organized by the Czechoslovak Academy of Sciences, representatives of specialized areas of the natural sciences met with philosophers and economists. Why?

[Answer] History has already confirmed the importance of close collaboration between the natural and the social sciences. Phenomena in the area of the natural sciences affect our world view. It is the duty of the philosophers to use their knowledge of what is happening in the natural sciences to influence how we are brought up to view the world, to modify human understanding. This leads to an important inverse relation: if people understand the phenomena of the natural sciences in their social connections, it is easier to put into practice the results of the natural sciences. We should accord greater significance than we have in the past to collaboration with economists in putting biological engineering methods into practice, especially in establishing relations between a scientific research institute and the enterprise using its results, since they are economically related. Stated simply, one must not only discover something but also explain the discovery and perform calculations.

[Question] As scientists and researchers in the natural sciences, do you feel that certain social sciences care little about your problems?

[Answer] The misguided opinion prevails that biological engineering processes are the most inexpensive methods of production. The rub is, the research period itself is costly and requires both financing and collaboration from industry, with respect to manufacturing modern research equipment and specialized equipment for modifying genetic material. There is a particular shortage of the latter, so that we must construct some of the required equipment ourselves or obtain it through exchange with other institutes and laboratories. Compared with the amount of scientific materials commercially produced throughout the world, this is, however, pitifully small.

[Question] Has it ever happened that you had something specific to offer but no one was interested in it?

[Answer] There have been such cases. The idea still prevails in practice that its better to use familiar production methods, tried and true, problem-free. An innovation is often considered disruptive and superfluous. Enterprises are not sufficiently interested to bother with something new. Of course, they can be excused for this, since it often happens that when they introduce something new, even if it is useful, they pay for it. There are areas, however, such as health care, where one should take a closer look at things before deciding. As a minor example I might mention the fact that double-stranded RNA can serve as an inducer of interferon, increasing the resistance of an infected organism to viruses. To the present day, despite much talk, it has not been possible to produce these compounds, proven effective, for medical purposes.

[Question] Does the future then belong to biological engineering?

[Answer] Biological engineering methods, especially those based on gene manipulation, are without a doubt an area of the economy which belongs to the future. For the first time in the history of financing the research and use of new manufacturing processes throughout the world, investments are being made in this branch of science without any strict requirement for

solving a specific goal-oriented task with the shortest possible payback. This is evidence, among other things, for a revolution in these new approaches, and for the great promise of their practical application on our planet. Socialist society certainly has many ways to make use of the advantages of its system, and for the directed development of modern processes of biological engineering and gene manipulation as their scientific basis. Evidence for this is the recent discussions and decisions of the supreme party and government agencies in our country and in the other CEMA countries.

9832
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CZECHOSLOVAKIA

BRIEFS

NEW PHARMACEUTICAL INSTITUTE OPENED--Hradec Kralove (Czechoslovak Press Bureau)--By a resolution of the presidium of the Czechoslovak Academy of Sciences, on 1 January 1985 an Institute for Experimental Biopharmaceutics of the Czechoslovak Academy of Sciences [CSAV] was set up in Hradec Kralove. The establishment of this scientific research institution is a response to the conclusions of the Eighth Plenum of the Central Committee of the Communist Party of Czechoslovakia in the Eastern Bohemian Region, where, with the support of the Regional Committee of the CPCZ, already existing laboratories of the CSAV in Hradec Kralove, Olesnice (Orlicky Hory area), Dlouhy (Rzy area) and Pardubice are being fused into a single organizational unit. The idea behind this research center, which is integrated with the research activities of the College of Pharmacy of the branch of Charles University in Hradec Kralove, is the consistent and constantly increasing interconnection of basic pharmaceutical research, oriented toward formulating the relations between the chemical structure of drugs and their activity in the human body, and research aimed at the development of new drugs. [Text] [Prague RUDE PRAVO in Czech 2 Jan 85 p 2] 9832

CSO: 2402/7

SCIENCE MINISTER ON 1985 FUNDING, OBJECTIVES

DW230959 [Editorial Report] East Berlin Domestic Service in German at 1600 GMT on 18 January carries a 45-minute recorded "listeners forum" program in which Dr Herbert Weiz, deputy premier and minister of science and technology, answers listeners' questions about his ministry's activities. He says that in 1985, some 5 percent of the national revenue--M10.8 billion --will be spent on science and technology. These funds "are in accordance with our economic requirements and possibilities," but "every mark we spend on research and development must yield high profits," he stresses.

Regarding qualified scientific cadres, he says that the GDR occupies a good position compared with other countries. "Any neglect in this area will in a final analysis have very negative effects. This holds true for all industrial countries," Weiz says. It is important for research and development cadres to be employed everywhere as usefully as possible "so as to ensure a high scientific level and, in particular, reduce the research-development-production cycle."

Responding to a question, he says that the GDR has "great intellectual potential," referring in this connection to what he calls "the workers' qualification structure." "We have 5.5 million skilled workers and foremen, more than 2 million innovators, 1.5 million university and technical school cadres, and about 200,000 employees in research and development." The material basis also is "modern and efficient," the minister notes. "For instance, the combines produce important rationalization equipment. This will be systematically continued. One-third of the machinery in the combines and factories is no older than 5 years, and 60 percent is no older than 10 years."

Asked about "the growth of the economic efficiency of scientific-technological progress" in 1984, Weiz states that last year "science and technology made the largest contribution economic growth ever." Some 5,450 new products and technologies were placed in production, and the level of quality has improved considerably. He says that the state plan lists more than 800 peak performances for 1984, and since 1981, the time required to complete a development task has been reduced by about one-third. "In 1984, the average time was no more than 20 months in industry, and the combines are making great efforts to reduce it further."

Answering a question about the most promising development processes, the minister says that they are usually called key technologies and include "microelectronics, robot technology, flexible automation, coal refining, the chemical and metallurgical refining industry, biotechnology, and automated data processing. New solutions for rational energy utilization and for the most economic material input are very important for the future. There are new methods for the separation and processing of raw materials and new ceramic materials." Weiz defines the term biotechnology as "the application of biological processes in industrial production. New knowledge in the biological sciences, which 10-15 years ago led to industrially utilizable genetic and immunity technology, has raised biotechnology to the rank of a key technology. Modern biotechnological processes are increasingly being used in the pharmaceutical industry, for refining chemical products, in plant and animal production, in food production, and in environmental protection. It can be compared with microelectronics because biotechnology will also have broad effects on the development of the production forces."

Asked whether the latest results of science and technology have led to "changes in the production lines of our combines," Weiz says, "most certainly," mentioning in particular "changes in the variety of products and in the technical ceramics, light conductor technology, and microelectronics." New technologies in the refining of raw materials and energy resources also require new machinery and equipment, he notes. In addition, there are "new demands on the supply industry that will essentially determine its future production in the areas of biochemicals and highly refined chemicals, new materials for microelectronics, and magnetic data storage. This is by no means everything. It is important that we recognize the necessary changes in production lines that result from new findings in research and development as early as possible so that the combines can adjust to and actively shape this process," the minister states.

For more effective research, Weiz considers it important that "research and development tasks be given that are based on economic requirements and that will promote streamlined production in the combines." He stresses "that the work time of researchers, designers, technologists, and project planners must be fully utilized for solving these tasks, and the abilities of the cadres fully applied in accordance with their qualifications."

Asked what science is doing in 1985 "to help improve supplies of more good-quality consumer goods," the minister notes that "regarding consumer goods, the resolutions of the party and government envisage an average annual rate of innovation of 40 percent. This means that consumer goods must be based on the latest scientific-technological findings and be largely produced at low cost from our own raw materials." Some 250 state plan tasks are aimed at a more comprehensive consumer goods supply, including new developments in entertainment electronics; space and material-saving solutions for electric household appliances; the development of new designs in the furniture industry; and the higher refinement of domestic raw materials for textiles, furs, and leather goods.

Weiz states that science and research will continue to help strengthen "the economic utilization of energy as a main pillar of our energy policy. This is inevitable until the optimum use of energy in the designing of technological processes, the engineering of products, and the projecting of buildings has been found." There are still "very many reserves," he adds.

Regarding the development of sensor technology, the minister notes that on the basis of modern semiconductor technology, "sensors have been developed that can detect the most varied physical and chemical quantities," and research work is being continued intensively. Another question deals with "recognizing objects by their size, shape, and location independent of the human eye," which is of growing importance for automation technology. Weiz says in this respect that this is still a complicated problem to which scientists throughout the world are devoting a lot of effort. "The so-called CCD elements that are produced in the GDR are gaining importance for modern camera technology." They are produced with a specific microelectronics technology and can be "utilized in optical reading devices to recognize letters or in cameras for industrial use. CCD lint-reading cameras can be kept very small and sturdy. Their utilization decisively determines the scientific-technological level of industrial robots." Since December 1984, a CCD line-reading camera has been mass produced.

Answering a question about the better utilization of raw materials, Minister Weiz states that the focus is on brown coal, potash, and mineral salts, as well as on raw materials for the building materials, glass, and ceramics industry. "Comprehensive research work is also being done on tin, copper, aluminium, and tungsten, and some results have already been transferred into production. Scientific-technological progress in microelectronics requires that we also supply raw materials such as germanium, selenium, and silicon. They are found in our soil, and we must use new production and separation methods to achieve a positive cost-yield relationship," Weiz concludes.

CSO: 2302/59

GERMAN DEMOCRATIC REPUBLIC

PRODUCTION CELLS WITH IR 2SO ROBOT EXAMINED

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 9, Sep 84
pp 567-569

[Text] The manufacturing cell (Figure 1) consisting of a high-performance lathe DFS 2/CNC, and industrial robot IR 2SO and a station for stacking pallets permits high-efficiency industrial manufacturing of rotationally symmetric parts in small and medium mass production. This manufacturing cell is well adapted to turning chucked parts of the most varied workpiece contours, tight dimensional and shape tolerances and high levels of surface quality. By means of automatic workpiece input and manipulation it is possible to have minimal labor manufacturing in one shift.

High reliability of the mechanical and electrical component groups guarantees a high level of availability of the manufacturing cell.

The manufacturing cell DFS 2/CNC IR 2SO is usable for the following assortment of parts:

i. outer diameter, da = 80 to 250 mm,

ii. inner diameter, di = 20 to (da -10),

iii. workpiece length, 20 to 200 mm,

iv. mass, up to 20 kg.

The equipment for automatic workpiece manipulation permit loading the FC DFS 2/CMC IR 2SO with stackable chucked parts. The manufacturing cell FCDF 2/CNC IR 2SO consists of:

i. basic machine with control CNC-H 645,

ii. operating panel of the control CNC-H 645,

iii. loading robot IR 2SO with double caliper UGp and adapter,

iv. station for stacking pallets,

v. control for the manipulatory system IRS 610 logic component,

vi. pressing device.

The following is a short characterization of the loading robot IR 2SO with adapter:

The machine-integrated industrial robot IR 2SO is shown with an adapter of the lathe machine (Figure 2). It extracts the workpieces from a fixed location in storage and transfers the workpieces to the lathe. The IR 2SO system is universally designed for manipulatory technology with fixed positions on the basis of structural component groups providing translational and rotational movement.

The modular construction, in which every axis is usable by itself in its own functional domain guarantees a many-sided area of application. The robot has axes driven by electric motors and possessing a mechanically constructed system of calipers which is usable as a double caliper and also as a single caliper. The pressing device attached to the IR 2SO assures a good workpiece attitude in the chucking jaws.

Construction of the IR 2SO

The IR 2SO has three NNC axes (Y-A-B) with the following functional content:

i. Y-axis, linear unit

Motion of insertion into the workpiece chucking device of the lathe with two fixed positions

ii. B-axis, rotational unit

Motion from storage to the machine and back (overhead storage) with two fixed positions and one intermediate position

iii. A-axis, rotational unit

Rotary motion of the caliper with four fixed positions

iv. Pressing device

Additional structural component for plane-parallel orientation of the workpiece in the chucking jaws

v. Calipers

Additional structural group for grasping chucked parts or shaft parts, operating as individual calipers or double calipers in a radial or tangential arrangement

vi. Adapter

Additional structural group for bringing up equipment to the lathe whenever direct attachment to the lathe bed is impossible.

Performance Parameters of the IR 2SO

Axis	Displacement	Velocity
Y	160 mm	0 to 0.5 m/sec
B	220°	150°/sec
A	0°, 90°, 180°, 270°	180°/sec
Position repeatability accuracy	±0.3 mm	
Workpiece dimensions	80 to 250 mm outside diameter	

The FC DFS 2/CNC IR 2SO in conjunction with the station for stacking pallets guarantees for each workpiece size automatic processing and loading of batch sizes in the range from 35 to 315 pieces without intervention of the operator. The following effects upon the national economy are obtainable:

i. 25-percent increase in labor productivity,

ii. an increase in quantitative production by more than 10 percent,

iii. creation of conditions necessary for increasing available useful time with simultaneous reduction in the employment of attendant operators,

iv. fully automatic high-quality processing of chucked parts during a period of at least one shift,

v. improvement in working and living conditions and improvement in worker safety.

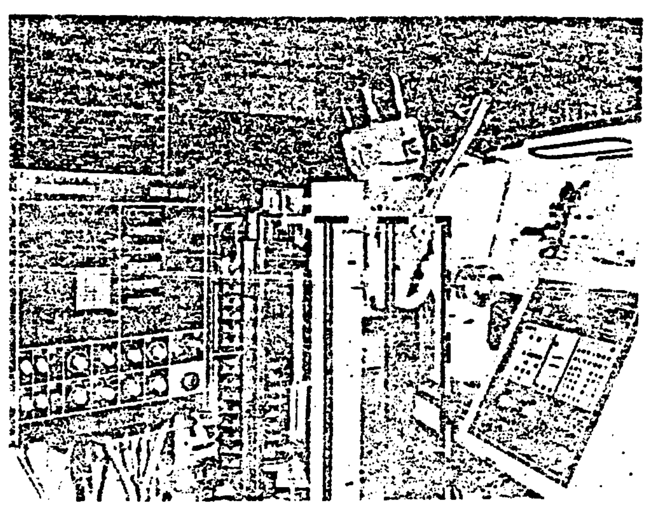

Fig. 1. Manufacturing cell with IR 2SO and station for stacking pallets.

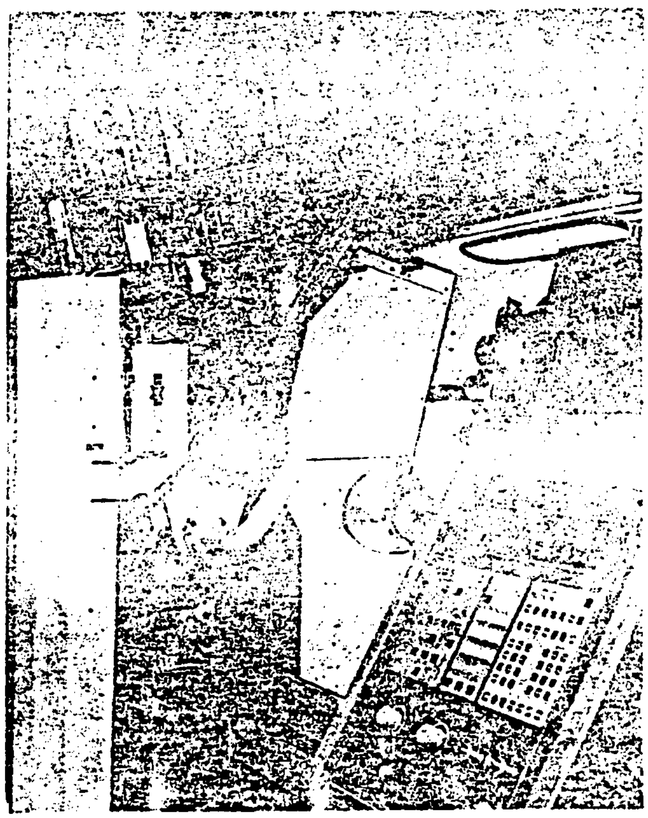

Fig. 2.

Fine-Drilling Machine With Production-Line Table for Processing Axle Journals (Figure 3)

The special fine-drilling machine with production-line table serves for re-drilling and fine drilling and also for chamfering and slotting both eyes of axle journals. The modular construction of this machine guarantees optimal adaptation of the structural units to the processing task and hence guarantees a substantial increase in productivity as compared with the traditional manufacturing technique. Using this special machine the manufacturing time is reduced by 2 minutes for each axle journal. The machine operates automatically; only workpiece changing is done manually. It is equipped with its three processing stations and one workpiece-changing station to process four types of workpiece. Workpiece pickup and workpiece chucking have been adapted to the preliminary processing machines.

With the aid of custom-manufactured special tools and equipment all quality requirements affecting the processing task are met optimally. In the automatic work cycle the special machine guarantees a drilling tolerance of H 7 for a maximum rough depth of $R_t = 10$ µm as well as a coaxiality of 0.05 mm. In order to avoid bit cracks in the drill holes the tools are withdrawn while in clearance position.

For use in fully automated manufacturing segments of large-scale and mass production the manufacturer is increasingly equipping his special machines with loading robots produced in-house.

(Manufacturer: VEB Machine Tool Factory "Vogtland" Plauen)

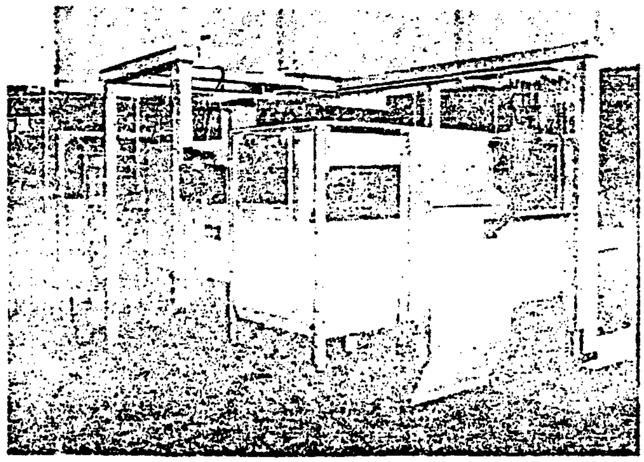

Fig. 3.

Horizontal Drilling and Milling Machine WH 10NC
(Exporter: Strojimport, Prague) (Figure 4)

The model WH 10NC can be set up as a horizontal drilling and milling machine in table configuration with movable spindle, 100-mm diameter, without steady rest for long drill rods. In consequence of its engineering design the machine is suitable for precision-coordinate drilling, drilling out and milling in prismatic parts up to a mass of 3,000 kg. It can be used in individual manufacture and production-line manufacturing.

Technical Data

Spindle diameter	100 mm
Spindle inside taper ISO	50
Spindle displacement (Z-axis)	530 mm
Spindle head stock adjustment (Y-axis)	900 mm
Sliding table transverse adjustment (X-axis)	1,250 mm
Sliding table longitudinal adjustment (W-axis)	1,000 mm
Workpiece mass, max	3,000 kg
Programmable spindle rpm	16 to 1,250 rpm
Displacement of all component groups	4 to 2,750 mm/min
Quick return of all component groups	4,500 mm/min
Total power requirement of the machine	32 kw
Space requirement of the machine including distributing switchboard and NC system	6,130 mm x 3,600 mm
Mass of the machine	12,800 kg

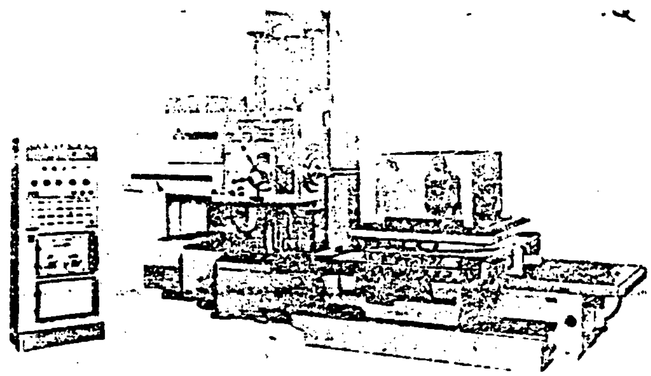

Fig. 4.

Centerless Grinding Semiautomatic Machine 3E180B
(Exporter: Stankoimport, Moscow) (Figure 5)

The semiautomatic machine is intended for grinding cylindrical and conical workpieces.

Workpieces of steel, cast iron, glass and plastic can be processed.

Processing precision:

Deviation from roundness in mm	0.0008
Roughness of processed surface in µm	$R_a = 0.16$

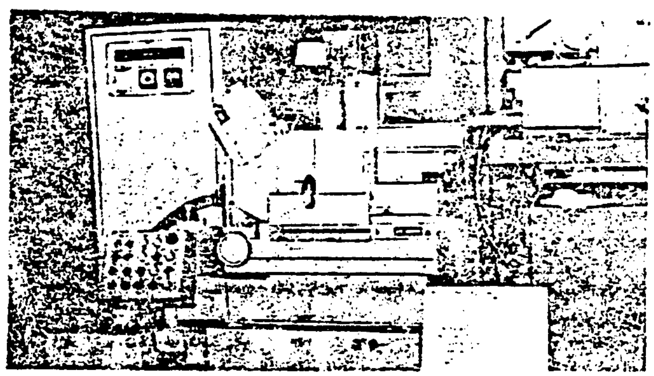

Fig. 5.

Technical Data

Diameter of the workpiece to be processed, max	10 mm
Diameter of the workpiece to be processed, min	
In through grinding	0.2 mm
In plunge-cut grinding	0.5 mm

Length of the workpiece to be processed, max	
In through grinding:	
Without special equipment	56 mm
With special equipment	1,000 mm
In plunge-cut grinding:	
With maximum grinding body height	56 mm
Grinding velocity	35 to 60 m/sec
Electric motor power	
For driving the grinding body	2.5; 2 kw
Dimensions	1,350 mm x 1,100 mm x 1,500 mm
Mass	1,200 kg

8008
CSO: 2302/46

GERMAN DEMOCRATIC REPUBLIC

ELECTRICAL FEATURES OF NEW DNC, CNC SYSTEM VIEWED

East Berlin MESSEN STEUERN REGELN in German Vol 27, No 10, Oct 84 pp 434-439

[Article by W. Fritzsch, D. Kochan, J. Schaller and H. J. Zander]

[Text] 0. Introduction

Under present conditions it is the goal of manufacturing to ensure productivity while maintaining efficient utilization of capacities and short workpiece transit times. Products which are manufactured in small batches in accordance with the wishes of clients and with frequent changes of the articles produced call for flexibility in the production system. This must be guaranteed by the basic technological system, by the control system and by the system organization. This demands new system designs in which the central problem is in particular the effective handling of information flow by means of modern automation.

It is the intention of this article to analyze those control structures capable of solving the problems of a flexible minimal-labor manufacturing process. This article also aims at describing the present state of development of equipment technology and at surveying possible ways of modeling control processes. Moreover, we shall attempt in this paper to systematize concepts which are frequently differently interpreted in various specialized disciplines, with a view toward creating the prerequisites for interdisciplinary cooperation.

1. Problems and Information Flows in Manufacturing Systems

Two phases may be distinguished in manufacturing: the phase of preparation and the phase of performance. Manufacturing performance requires both organizational and technological activities.

The handling of organizational activities is accomplished through manufacturing control (Figure 1). The task of the latter is the initiation, the surveillance and the protection of the performance of manufacturing contracts in terms of demand (quantity, schedule date), quality, cost and conditions of labor [2]. Manufacturing control is also responsible for the distribution of manufacturing contracts over the various subsystems, i.e., the manufacturing cells or machines and equipment.

The technological activities are brought about through process control (Figure 1). Since in a complex manufacturing cell individual subprocesses, TP_{nj}, are always taking place which involve, for example, machine tools, robots, transport equipment, turnover stations, pallet stations, measuring stations, unloading stations and the like, the process control equipment for one cell may be decomposed into subordinate control equipment, SE_{nj}, for the individual subprocesses, TP_{nj}. A process computer or microprocess computer, SE_n, can be used to coordinate these subordinate controls and this computer can in turn receive instructions from the superior manufacturing control level.

The preparatory phase of manufacturing includes the following: the design of the products to be manufactured, technical preparation and optimizing and the performance of manufacturing, manufacturing planning and the design of operation sequences (path functions and switching functions) to establish the succession of technological activities. And based upon these there is also included in the preparatory phase the programming of process control equipment.

Through manufacturing planning there are established the goals of manufacturing and there are also formulated the manufacturing tasks which must be performed if these goals are to be reached [2]. Thus manufacturing planning supplies the formulation of tasks to be carried out by manufacturing control. In a parallel way the formulation of tasks for process control is determined by process control design. In the diagram of Figure 1 two information flows are to be seen:

i. Information flow from the preparatory phase to the performance phase (horizontal information flow). Here one is dealing with an open chain of effects. Computers used in this information chain operate at the present time largely off-line. In a subsequent phase there can also take place data acquisition and evaluation of the manufacturing performance.

ii. Information flow between manufacturing control equipment, process control equipment and the process (vertical information flow). This information flow takes place in each case in two directions (initiation and feedback). In this branch computers operate largely on-line (CAM).

Figure 2 shows in summary the data flow in a manufacturing process. Frequently in factories and combines separate information circuits have come into existence which result from the cabling structure. In order to secure flexibility the technical information circuits should be largely integrated with the plant-industrial information circuitry. The link accomplishing this could be the plant data acquisition. From the cybernetic point of view this must involve a disengagement of intermeshed structures somewhat along the lines of the decentralized production control of the Japanese Kanban principle [3].

With regard to the total automation of all subordinate tasks to be carried out with the use of EDP facilities, stored program controls and microprocess computers the data continuity of the horizontal and vertical information flows (Figure 1) plays an essential role. A prerequisite for this is a complete algorithmic reduction of the processes in the preparatory phase as well

as a modeling of the process sequences in the manufacturing performance phase. The sequences of events in manufacturing processes may be characterized as certain successive activities. These activities can be either motions in space (path functions) or general switching activities (switching functions). They are triggered by path instructions or switching instructions. The switching instructions are provided either by binary sequence controls (e.g., stored programmable or PC controls). The sequences of motions consisting of point controls, segment controls or path controls are prescribed and controlled in their coordinates through numerical values. The NC controls were developed for processing this numerical data flow. The NC controls are today equipped entirely as CNC controls using microprocessor computers.

At the present time technological functions are being integrated through the coupling of CAD/CAM components. The aim here is the linking together into a network of different functional areas on the basis of a common data base in order to avoid [sic] the reuse as frequently as possible of data files or source data in setting up new models. This relates to

i. processes of design, engineering and drawing;

ii. technical calculations in the engineering process;

iii. the creation of parts lists;

iv. activities preparatory to manufacturing;

v. the creation of NC programs.

2. Developmental Status of the Technology of Control Devices

2.1. CNC Controls

If one compares the functional content of wire-programmed NC controls (Figure 3a) with that of the stored program CNC controls (Figure 3b), then assuming the same basic requirements a substantially more extensive area of tasks can be handled.

Figure 3b explains the most important task complexes which are presently required for the control of manufacturing cells and which up to the present have been practically realized. The functional range shown is covered at the present time by internationally known CNC controls, including amongst others the CNC 600-3.

Thus it can be asserted that at the process level using the stored program CNC controls decisive qualitative new developments have been obtained with respect to the following features:

i. intelligent operator assistance;

ii. efficient and expandable function complexes of process automation;

iii. the possibility of taking over subordinate tasks of manufacturing control or manufacturing organization;

iv. possibilities of coupling and communication with superior-level computer systems or peripheral devices.

Being possessed of these properties and features, CNC controls designed for the flexible control of machine tools can at the same time also be employed for additional industrial control tasks, in which motions must be performed from one arbitrary point in space to another. That this is the case is evinced, for example, by the fact that in the complex automation of discrete production processes use is made of CNC controls or specially equipped and modified versions thereof for additional task areas--e.g., the control of transporting equipment (cranes).

Table 1 gives a survey of the control systems available in the GDR for manufacturing equipment.

2.2. DNC Controls

Direct numerical control (DNC) is suited to manufacturing automation throughout the shop (Figure 4). The characteristic feature of the DNC principle is the on-line supply of data from one central process computer to several numerically controlled processing stations. The data transmission procedures permit concurrent operation and a coupling of the technologically determined information flow with the organizational status of the operations. In this way the basic functions and the expanded functions of DNC create for manufacturing automation the essential prerequisites for information processing and manufacturing control required by modern flexible manufacturing systems. With the increasing use of stored program controls the DNC process is gradually released from its time-critical signal-and-segment bound highly formatted basic function at the controls of the processing stations and is thus made usefully available for other surveillance tasks. This involves especially the integration of quasi-processing functions, programs for robot controls, measurement stations, pallet and transfer stations for workpieces and tools, washing and cleaning processes as well as unloading processes for auxiliary materials. In modern manufacturing cells such tasks must be carried out with minimal labor. And in flexible manufacturing systems these tasks are expanded to include the control of material flow between the manufacturing locations and also to include bench work.

Consistently with the historic development process DNC has arisen out of technological information flow as a paperless information transmission from the phase of manufacturing preparation to the phase of manufacturing performance. Because of its capacity for real time information supply the process is especially suited to the centralized tasks of manufacturing surveillance. The automated minimal-labor manufacturing process requires in addition to machine tool surveillance functions also process surveillance tasks such as

i. tool control and tool wear control,

ii. workpiece surveillance,

iii. processing surveillance,

iv. manufacturing quality surveillance.

These surveillance functions must be performed by means of identifying devices associated with the process. The process models must through suitable selection carry out a transmission of information to the DNC computers and must modify machine-internal parameters depending upon the situation. For the purpose of guiding statistics and trends defining the progress of the process and the drift of the process the DNC computer can by a polling process create advantageous prerequisites for governing the real image of the manufacturing process or of the indicator model of a flexible manufacturing system. The identification model is essential for process surveillance or process protection. It constitutes the foundation of operations control in processing, in auxiliary processes and in material flows. These operations must be carried out while subject functionally to overlaps in time and space and they are subject to changes arising for organizational and technological reasons. Of importance in that context is the recognition of functions entailing the risk of collisions and functions independent of the existing situation. For this function preference should be given to utilizing the hierarchical position of the DNC computer.

3. The Modeling of Manufacturing Processes

3.1. The Total Model

Any automation must be based upon the construction of suitable models. The theoretical treatment of systems and processes of manufacturing technology entails substantial difficulties because of their high dimensionality. Therefore it appears logical to subdivide the manufacturing process into subprocesses and through coordination of subordinate goals to determine the overall goal of the manufacturing process (compare Figure 1). Table 2 shows a possible subdivision of a manufacturing process into three subsystems which are controllable by means of appropriate controls (microcomputers), each in terms of the sought subordinate goal. A coordinating control is superimposed upon these "subordinate controls." This coordinating control coordinates the subordinate goals in terms of the total goal setting. Whether the controls are to be in a concentrated arrangement in a computer or distributed over several subordinate computers and structured functionally and hierarchically in one multicomputer system is an issue not in modeling but in the design of the control system. The configuration of the control system (computer system) can take place only after one has found the functional interconnections (and hence the data flow).

3.2. The Modeling of Processes of Manufacturing Control

The modeling of manufacturing processes encompasses the following process elements:

i. labor force;

ii. the objects on which labor is expended;

iii. work equipment.

These elements find expression in schedule planning and capacity planning as well as in the control and surveillance of manufacturing.

For modeling one employs simulation models and real time models. The simulation models have a certain lead time with respect to the processing operation and represent a conceptual anticipation of the latter in the form of objective determinations, temporal and geometric, with regard to the interaction of the process elements and with regard to coordination of the subordinate processes [4]. These models are described in terms of decision tables, graphs or Petri networks with the occurrence of specific events or situations being representable stochastically.

The models contain principally mathematical-technological causalities and target functions aiming at an optimal process creation. Such target functions of external process optimizing can be, amongst others:

i. minimal manufacturing time;

ii. minimal manufacturing cost;

iii. maintenance of a machining form class.

These goals are attained through variation of manufacturing-technical working parameters (tool advance, cutting speed) within a restrictive engineering field. With modern equipment technology it also becomes possible to have real time acquisition of process states in the coordinated sequence of operations controlled by a processing program and such manufacturing technology opens the door to new approaches.

Using real time models it is possible to achieve process surveillance and the guidance of images of the manufacturing process. On the whole in manufacturing processes on-line process control and process regulation within a closed cycle are not yet effective. Therefore real time models (identification models) have thus far been scarcely ever used.

3.3. Modeling of Price Controls

In the design of a system of process control (compare Figure 1) it is a question of codifying the control task--that is, the behavior to be established by means of the control--by the use of an appropriate descriptive device. To this end one can use, for example, logical equations or logic plans. By means of these one describes not only the behavior of a control facility but they also at the same time form the basis of circuit engineering organization with controls based upon programmed interconnections (VPS). This is because these logical equations specify the logical elements and the interconnections

to be executed between the latter and in consequence, in addition to information regarding the behavior of the system, these logical equations also contain structural information needed for the cabling (description on the structural level).

In the case of stored program control facilities (SPS) naturally it is also possible for logic plans or logical equations to be employed as the point of departure for setting up the programs, although here the structural information is not of foreground interest. For this it is entirely sufficient, and moreover advantageous, if one describes only the behavior of the control to be achieved. The descriptive devices to be used for this can be tabular or graphical in orientation or can consist of symbol sequences. Particularly easy to survey in a primary codifying of tasks are graph-oriented descriptive devices. These include [5]:

i. automata graphs;

ii. program sequence graphs;

iii. Petri networks;

iv. function plans.

But under some circumstances a compact notation of tasks may be attained by means of tabular descriptive devices such as sequence tables or decision tables. [6] gives a more comprehensive evaluation of descriptive devices.

The conversion of the descriptive devices into a program for a SPS can in principle be achieved with the aid of an assembler language. But it is better when a specialized language can be used which in conjunction with the compiler or interpreter permits working up a descriptive device directly for purposes of structure description or behavior description.

For the class of tasks considered, there exist in the GDR the following specialized languages at the level of structure description:

i. interconnection-oriented specialized language for PS 2000 [7];

ii. structural component-oriented specialized language PROLOG 1/2 for Ursalog 5010/5020 [9];

iii. specialized language based upon Boolean equations for PC 600 [8].

The following specialized languages on the level of behavior description (graph-oriented) are being offered by advanced school or academic sources:

i. for program sequence graphs: MAKRO-FAST [10];

ii. for Petri networks: SGM [11], PSI [12];

iii. for function plans: FUP [13].

In modeling process controls for manufacturing systems a special role is played by those activities which aim at achieving motions between arbitrary points in space over prescribed pads. For such subordinate tasks (CNC controls), in the spirit of international standardization, autonomous specialized languages have been developed which permit direct programming (e.g., CNC-H 600 [14]) of workpiece contours and tool advance speeds. Appropriate specialized languages also exist for the textual programming of robots.

Closing Remarks

This paper is an attempt to analyze the problems which arise in connection with minimal-labor manufacturing. The aim has been to carry out the analysis both from the point of view of manufacturing technology and also from the point of view of automation technology and we have also sought to suggest approaches to problems arising in these areas. An effective solution of these problems will be possible only through close interdisciplinary cooperation between manufacturing engineers and automation engineers.

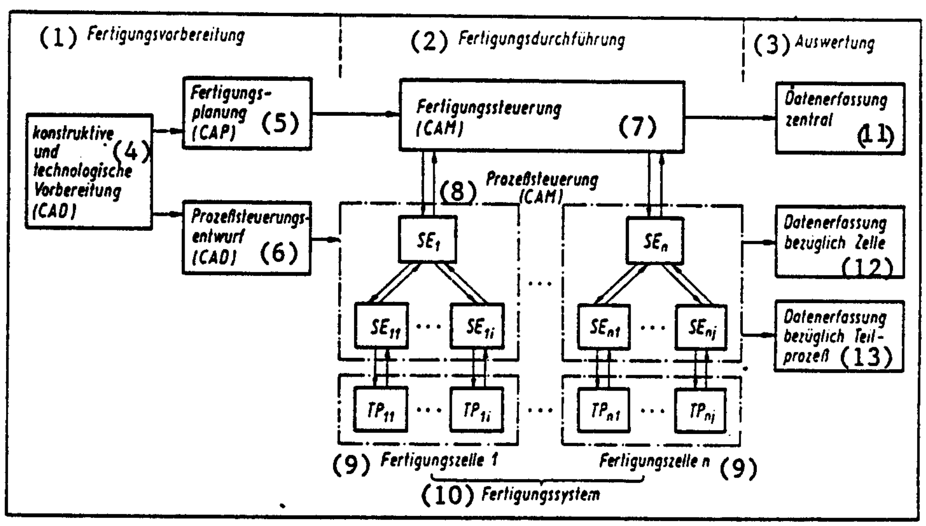

Fig. 1. Tasks in the preparation for and performance of manufacturing.

Key:
1. Manufacturing preparation
2. Manufacturing performance
3. Evaluation
4. Constructive and technological preparation (CAD)
5. Manufacturing planning (CAP)
6. Process control design (CAD)
7. Manufacturing control (CAM)
8. Process control (CAM)
9. Manufacturing cell ...
10. Manufacturing system
11. Central data acquisition
12. Cell-related data acquisition
13. Data acquisition related to a subprocess

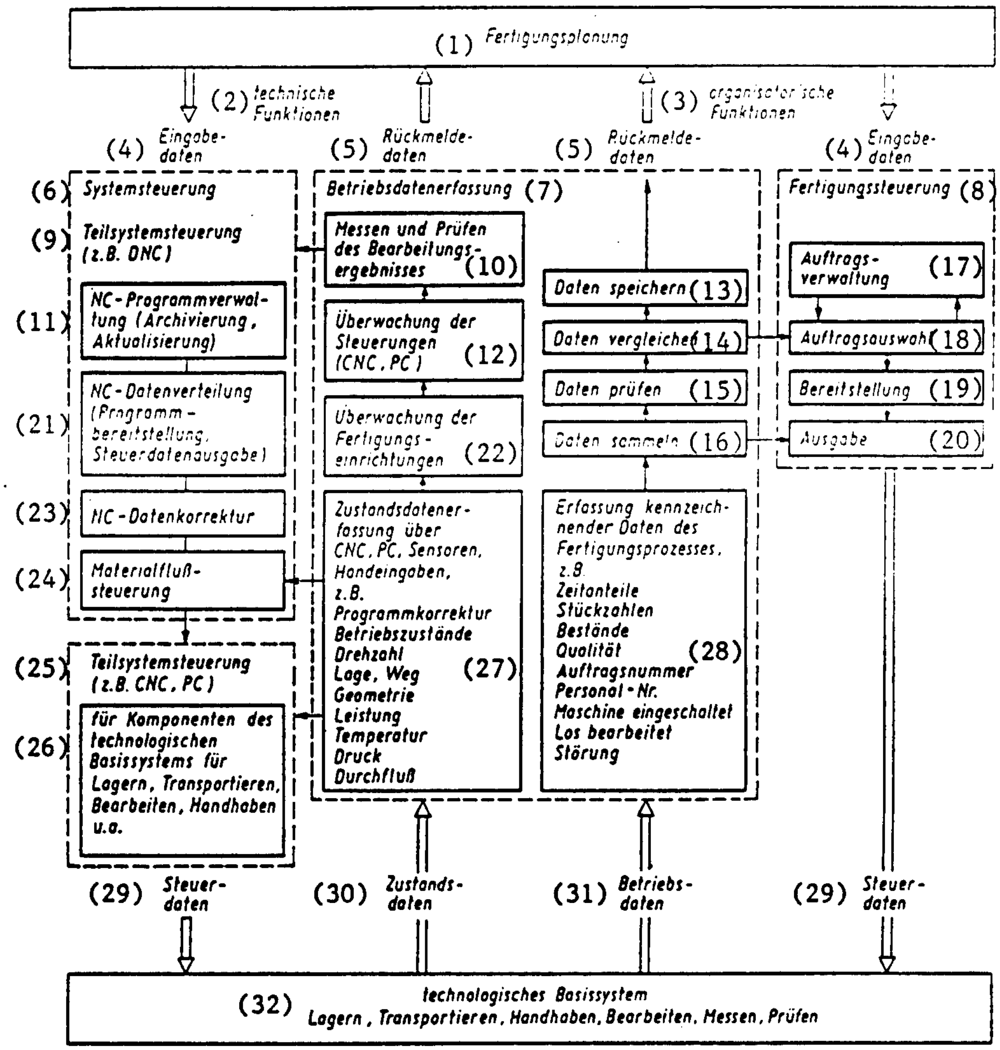

Fig. 2. Data flow in manufacturing.

Key:
1. Manufacturing planning
2. Engineering functions
3. Organizational functions
4. Input data
5. Feedback data
6. System control
7. Operations data acquisition
8. Manufacturing control
9. Subsystem control (e.g., DNC)
10. Measurement and testing of the processing product
11. NC program management (archiving, actualizing)
12. Surveillance of controls
13. Data storage

Key to Fig. 2 (continued)

14. Data comparison
15. Data checking
16. Data collection
17. Contract administration
18. Contract selection
19. Preparation
20. Output
21. NC data distribution (program preparation, control data output)
22. Surveillance of the manufacturing equipment
23. NC data correction
24. Material flow control
25. Subsystem control (e.g., CNC, PC)
26. For components of the technological basic system for storage, transport, processing, manipulation, et al.
27. State data acquisition regarding CNC, PC, sensors, manual inputs, e.g., program correction, operation states, rpm, position, path, geometry, power, temperature, pressure, throughflow
28. Acquisition of control data for the manufacturing process, e.g., time segments, batch sizes, inventories, quality, contract numbers, personnel number, machine switched on, lot being processed, trouble
29. Control data
30. State data
31. Operation data
32. Technological basic system; Store, transport, manipulate, process, measure, check

Key to Fig. 3:

1. Wired-program controls principle (NC)
2. Comparator
3. Commands
4. Feedback
5. Drive
6. Machine tool
7. Path measuring system
8. Stored program controls principle (CNC)
9. Alphanumeric dialogue (graphical displays); Program editing; UP technique
10. DNC connection
11. Disk storage
12. Magnetic tape cassette
13. Storage
14. Arithmetical basic functions
15. Interpolation process
16. Diagnostics
17. Compensation
18. Machine tool adjustment
19. Identification devices
20. Diagnosis
21. Error compensation

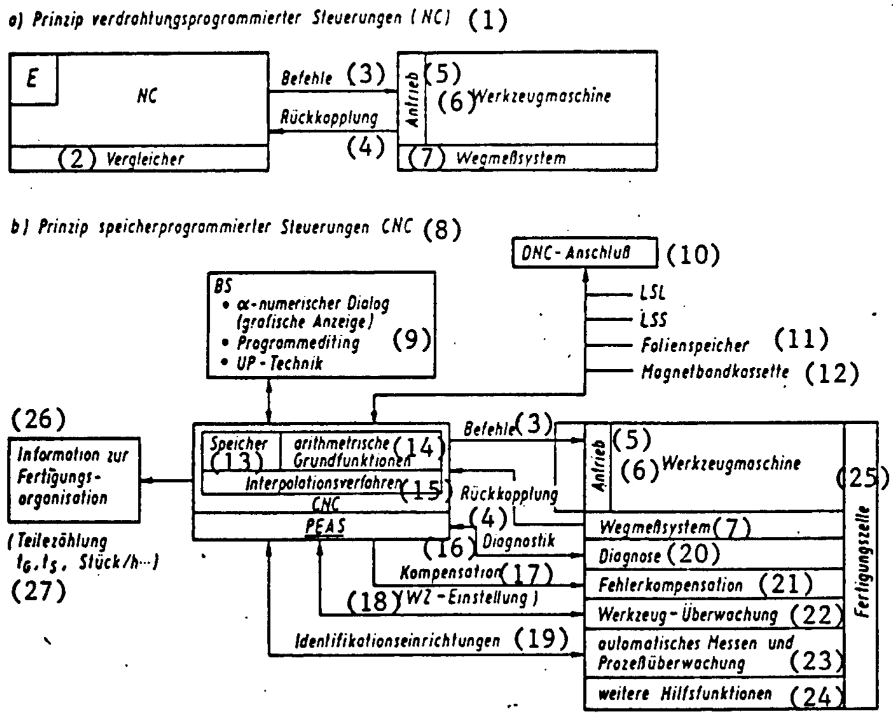

Fig. 3. The principles of programmable controls: a--wired-program NC control; b--stored program CNC control.

Key (continued)

22. Tool surveillance
23. Automatic measuring and process surveillance
24. Further auxiliary functions
25. Manufacturing cell
26. Information on manufacturing organization
27. (Parts counting t_G, t_S, pieces/hr)

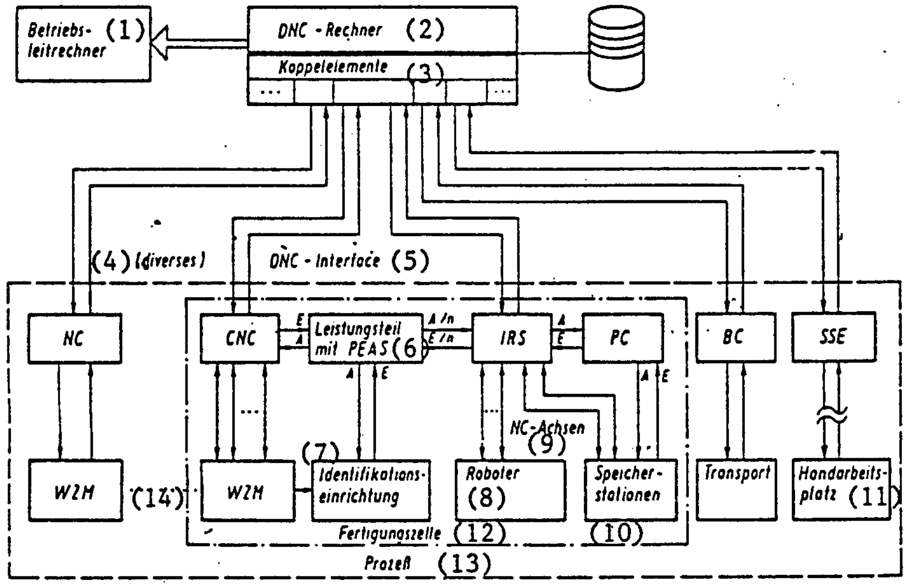

Fig. 4. Direct numerical control (DNC).

Key:
1. Operations management computer
2. DNC computer
3. Coupling elements
4. (Various)
5. DNC interface
6. Performance portion with PEAS
7. Identification device
8. Robot
9. NC axes
10. Storage stations
11. Manual bench work
12. Manufacturing cell
13. Process
14. Machine tool

Table 1. Control Systems for Manufacturing Equipment in the GDR (as of 1984)

System	Use	Controllable Axes	Interpolation Form	Measurement Resolution	Structural Component/ Microcomputer Base	Storage: Workpiece Program Storage	Storage: Technological Subprograms	Program Input/ Program Output	Function Scope
CNC 600-1	Milling Drilling	X, Y, Z 4th and 5th axis	3D linear helix	0.001 mm 0.001°	Microprocessor switching circuit family U 880; microcomputer system robotron K 1520	8 Kbyte CMOS-RAM or 12.2 Kbyte or 28 Kbyte DRAM unsupported	3 Kbyte + 4 Kbyte CMOS-RAM supported	LS reader/ puncher external, monitor, DNC system operation	Workpiece programming Relative programming and concatenated [?] programming Service programming Machine-adapted PMC Error reports of the CNC and process states of the PMC to the DNC computer
	Turning	X, Y	2D linear circular helix	0.001 mm		7 Kbyte CMOS-RAM	6 Kbyte		
CNC 600-3	Milling Drilling Turning	Measuring system and 5th axis for position regulation of main spindle	Analogous to CNC 600-1	Analogous to CNC 600-1		8 Kbyte CMOS-RAM supported, 16 Kbyte or 32 Kbyte DRAM	Measuring system of the main spindle in threadcutting/spindle aligning	Analogous to CNC 600-1	Extended NC programming Extended computer possibilities Workpiece control with 3D measurement scanner Edge life surveillance for tools Workpiece storage cataloging (pallet numbers) Automatic pallet changing Process data acquisition: Machine utilization Real time clock Piece time Use time [or setup time] Workpiece counting Path-dependent lubrication

Table 1 (continued)

System	Use	Controllable Axes	Interpolation Form	Measurement Resolution	Structural Component/ Microcomputer Base	Storage: Workpiece Program Storage	Storage: Technological Subprograms	Program Input/ Program Output	Function Scope
CNC-H 642	PS control for drilling/milling	X, Y, Z	2½D linear interpolation	(360°/2,000) (360°/20,000)	Microprocessor switching circuit family U 880; microcomputer system robotron K 1520	2 Kbyte or 8 Kbyte in supported RAM or EPROM as plug-in cassette	4 Kbyte in EPROM	Manual input, LB reader and external LB punch	Process-related program creation/automatic programming Program manipulation with multiple UP technique Correction of position-dependent machine tolerances Path-dependent guidance path lubrication Programmable end-position surveillance by means of a software terminal switch
CNC-H 645	Path control for lathes	X, Z/screw cutting	2D linear and circular interpolation	0.001 mm					
CNC-H 646	Path control for milling machines and processing centers	X, Y, Z	2½D linear and circular interpolation	(360°/2,000) (360°/20,000)					
PC 600	Preparation of control signals for machining and processing sequences in machine tools, assembly lines and special machines	480 inputs/outputs without MUX, 640 inputs/outputs with MUX	--	Cycle time $t_z (t_{RSE})$ 10 ms < t_z < 160 ms (3 ms < t_{RSE} < 10 ms) fast input		PC 601 maximum 8 Kbyte; PC 602, PC 603--16 Kbyte; can be equipped in steps of 1 Kbyte		Programming device PRG 600	Command scope: AND, OR, negation, multiple bracketing, conditional jump, addition, subtraction, multiplication, division, comparison (>, =, <), counter, floating point register
IRS 600	Robot control for 3 NC axes with point-to-point operation	5 axes of which 3 NC axes	--	0.1 mm 0.01°		3 Kbyte CMOS-RAM		Teach-in programming	Program module for manipulator motions Diagnostic routines

Table 1 (continued)

System	Use	Controllable Axes	Interpolation Form	Measurement Resolution	Structural Component/ Microcomputer Base	Storage: Workpiece Program Storage	Storage: Technological Subprograms	Program Input/ Program Output	Function Scope
IRS 2000	Robot control for 2 servohydraulic axes	5 axes with 30 programmable positions	Linear laminar potentiometer	0.1 mm cycle time 18 ms	Discrete processor switching circuit family U 808	4 Kbyte in EPROM		Device for initiating operations and programming	Control of technological motion sequences Simultaneous operation of the 5 axes Command range: 20 commands

Table 2. Formulation of the Modeling: Dissection of a Large System of Manufacturing Into Subsystems, Fixing the Target Settings in Process Guidance

Subsystem Products Workpieces Operands	Subsystem Manufacturing process Operations	Subsystem Technological equipment Work facilities Operations
Result: Manufacturing contract (geometric definition of the workpiece to be manufactured) Determination of all processing operations for workpiece manufacturer	Distribution of processing operations over individual machines (processing units) Product: Manufacturing system-oriented manufacturing program Machine-oriented processing operations in chronological order	Machine-oriented adaptation of the Manufacturing data Process path transformations Guidance control Collision examination
Engineering aids: NC programming systems Product: Workpiece-oriented manufacturing program Result: Work plan, target-actual comparison of the processing states		
Partial target: Work progress → maximum No idle times for workpieces	Partial target: Machine occupancy → optimum Technologically determined order of processing High capacity utilization	Partial target: Machine utilization → maximum Optimal processing times (workpiece life times) Preservation of a specific machining form class No shutdown times (machine troubles) No rejects

Total manufacturing target to be coordinated out of the partial targets of the subsystems: run-through time → minimum; manufacturing cost → minimum.

Biographies

Prof Dr Sc Techn Wolfgang Fritzsch (53) studied electrical engineering at the Technical Advanced School of Dresden from 1950 to 1955. After that until 1960 he was assistant at the Institute for Electrical Motors and Railways and at the Institute for High-Voltage Engineering of the Technical Advanced School in Ilmenau. Promotion A in 1960. From 1960 to 1965 in Jena and Dresden at the Central Institute for Automation where finally he was principal division chief. From 1965 to 1967 he was chief of specialties for instrument development at the Institute for Data Processing in Dresden. From 1967 to 1969 active in the VEB Rafena Works, Radeberg; from 1968 director for research and development. In 1969 he was appointed at first to an honorary professorship and then to full professorship for process automation at the Technical Advanced School in Karl Marx City. There, until 1981, he was chief of the "Process Automation and Automating Instruments" Division. In 1979 Promotion B to questions of process computing technology. Member of the board of the WGMA.

Prof Dr Sc Techn Detlef Kochan (49) studied manufacturing technology until 1961 at the Technical Advanced School in Dresden. From 1967 to 1970 division chief in the administration and development at the VEB Carl Zeiss, Jena. After that, deputy principal division chief in the machine tool construction research center of the GDR. In 1970 appointed lecturer and in 1975 full professor of manufacturing technology and technological programming at the Dresden Technical University; in 1965 Promotion A, 1971 Promotion B. GDR representative in the TC 5 of the IFIP.

Docent Dr Sc Techn Joachim Schaller (37) studied manufacturing technology from 1966 to 1971 at the Technical University of Dresden. From 1971 to 1975 scientific assistant at the Dresden Engineering Advanced School, information processing section. From 1975 to 1980 development technologists and section chief for putting a DNC system into production at the VEB Zemag Zeitz, a plant of the VEB SMK Takraf. Until 1983 scientific colleague of the plant director in the same plant. In 1975 Promotion A; 1982 Promotion B. In 1983 appointment as lecturer in process automation/manufacturing technology at the Technical University of Dresden, manufacturing technology and machine tools section. Member of the Commission for Continued Education in the Machine Construction FV of the Chamber of Technology.

Prof Dr Sc Techn Hans Joachim Zander (50) studied electrical engineering (specializing in weak-current technology) at the Technical Advanced School in Dresden. From 1959 to 1970 scientific worker and division chief at the Institute for Automatic Control Technology in the AdW of the GDR in Dresden. In 1968 Promotion A. From 1970 to 1983 division chief and area chief in the Central Institute for Cybernetics and Information Processing of the AdW of the GDR, institute section, Dresden. In 1971 Promotion B. In 1973 appointment as professor in the AdW. Since 1983 advanced school teacher at the Technical University of Dresden, section for information technology, WB automatic control technology and process control. Member of the board of the WGMA.

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8008
CSO: 2302/46

GERMAN DEMOCRATIC REPUBLIC

FLEXIBLE MACHINING SYSTEMS DESCRIBED

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 10, Oct 84 pp 592-594

[Article by H. J. Butters, Saalfeld VEB Machine Tool Factory]

[Text] 0. Introduction

The rationalization and gradual automation of short rotationally symmetric parts in the Saalfeld VEB Machine Tool Factory has been carried out in three stages:

i. part-specific manufacturing,

ii. automated production line for manufacturing toothed gears,

iii. automated manufacturing section for short rotationally symmetric parts.

The development of parts-specific manufacturing processes in the fifties was a decisive step toward the abandonment of the shop principle of mechanical manufacturing which had up to that time been traditional in machine tool construction.

By using existing conventional machine tools and as a result of their arrangement in proper technological processing sequence the first results were obtained at relatively low cost in such areas as division of labor, specialization of labor techniques, transport rationalization, motor machine operation, shortening of transit times, improvement in quality, et al.

With advances in technology and in-house development of mechanizing and automating equipment, a start was made in 1965 with the automated manufacture of gears and shafts. By means of transfer devices the parts were extracted from workpiece magazines and supplied to the machine tools.

The ratio of the t_A time to the t_S time (ratio of the sum of preparatory and clean-up time to the piece transit time) called for a minimum batch size of 150 to 200 pieces. With this it was possible to achieve an increase of 300 percent in the productivity of labor.

With the development of numerically controlled machine tools and with the development of industrial robot technology it became possible to create automated manufacturing also for small-scale mass production.

The intensively expanded production which has become obligatory necessitates taking new steps in automation. These requirements gave rise to the development of an automated manufacturing section for "turning and interior grinding" techniques. This was within the context of the construction of an integrated manufacturing section IGFA-C for short rotationally symmetric parts in small-scale and medium-scale mass production. In the course of solving this problem the factory carried out the requisite development of robot technology and the necessary creation of workpiece transporting facilities--all out of its own resources.

1. Statement of the Problem

The automated manufacturing section must be so configured as to yield a stepwise automation of the complex production process in order thus to achieve a long-term guarantee of the requisite level of efficiency [1]. With the development of technological units (TE) for the automated processing of a broad spectrum of parts the peripheral equipment must be so designed that it is possible to employ uniform structural components for the parts to be processed. At the same time there must be guaranteed an annual intake of parts having a novelty level of about 20 to 40 percent.

The following further conditions must be met while meeting the needs for intensively expanded production:

i. use of existing production buildings,

ii. development of autonomous technological units,

iii. automation of the TUL process as well as automation of manufacturing control,

iv. guarantee of in-house efficiency while maintaining current or increased production.

The continually increasing demands on the flexibility of the production of customer-specific equipment, manufacturing cells and entire manufacturing systems have the consequence that there is a steady rise in the manufacture of parts in small-scale mass production. The following parts assortment forms the basis of the development of TE equipment [2]:

Parts Assortment

Number of parts	700
Annual number of pieces	About 250,000
Piece transit times	1 to 8 minutes
Mass of the parts	Up to 20 kg
Mass of the transport unit	400 kg

Parts Assortment

Dimensions	Diameter from 20 to 220 mm
Quality	IT 7
Batch size	30 to 480 pieces

2. Configuration

The automated manufacturing section of the IGFA-C for short rotationally symmetric parts consists of five technological units (TE) of which three are TE lathe units and two are TE interior grinding units. There are in addition nine other machine tools.

The individual TE's are so designed that the entire assortment can be processed on each machine.

Because of continued use of the old setup for mechanical manufacturing in the plant the arrangement of the machines at the pallet shelf storage sites must take into account the intermediate supports of the crane runway.

Via the pallet shelf storage the workpieces and VWP are delivered in system pallets in consignment to the TE. By means of a transfer device the system pallet is delivered from the pallet shelf storage to the assembly device (Figure 1) [Figure not reproduced].

In the assembly device separation takes place along with the workpiece extractor followed by intermediate storage and then after processing there is a repositioning back in the same system pallet.

The part is transferred by the robot, with double calipers, over to the numerical processing machine.

The computer controls the process in such a way that the auxiliary operations are carried out during processing of the part on the machine.

Consistently with the priority prescribed by the computer the pallet is delivered to the transfer device by the automated shelf servicing equipment.

3. Characteristics of the Facilities

a. Machines

The automatic manufacturing section includes the following machine tools:

i. 3 DS 2-CNC 600 by the VEB 8th of May, Karl Marx City,

ii. 2 Si-4 MS by the VEB Berlin Machine Tool Factory, Berlin-Mahrzahn.

b. Robots

The loading robot IR 2SO (in articulated construction with hydraulic control and hydraulic drive)--Figure 2 [Figure not reproduced]--was designed and manufactured as an in-house resource by the factory. It has a double caliper with interchangeable chucking jaws. The double caliper has the advantage of short workpiece changing time at the machine tool since after the processed part has been extracted the new workpiece can be immediately inserted into the chucks. It is true that the double caliper cannot be used to extract the extract the workpieces directly from the pallet. The IR 2SO takes the parts from the intermediate storage (Figure 3) [Figure not reproduced].

c. Assembly Device With Workpiece Extraction Caliper

The assembly device transports the system pallet, depending upon the workpiece sequence to be extracted, below the axis of the workpiece extraction caliper. The workpiece extraction caliper works through the given row by transferring the workpieces to the intermediate storage or by extracting them from intermediate storage. The caliper is so designed that all parts of the total parts assortment can be picked up without changing the caliper. A sensor in the caliper controls the extraction of the workpiece (Figure 4) [Figure not reproduced] and assures the complete working of the workpiece stack in the pallet.

d. Transfer Device

The transfer device, functioning as a transverse changing device for the pallet storage, is a constituent of the assembly device and extracts the system pallet from the right-hand position of the pallet shelf storage and transfers it, after processing of the parts, to the left-hand position in the pallet shelf storage. By using the telescope produced by the VEB Storage Technology Plant, Karl Marx City, no special designs are necessary. In consequence, the same conditions are present as exist at the shelf servicing facility.

e. System Pallets With Interchangeable Auxiliary Positioning Apparatus

The need for auxiliary positioning apparatus and the need for their fixation required the development of a special pallet. In its dimensions it corresponds to a transport receptacle of size I.

Various parts size ranges were established for auxiliary positioning apparatus in order to be able to fix the attitude of the workpieces (Figure 5) [Figure not reproduced].

f. Pallet Shelf Storage With Shelf Servicing Facility

The pallet shelf storage consists of an automatic shelf servicing facility made by the VEB Storage Technology Plant, Karl Marx City, and also consists of two shelf rows, of which one is continuous and the other is interrupted by the crane runway supports. Control of the RGB is accomplished on the basis of the microelectronic programming device RGB 600 with PC 603.

g. Manufacturing Control

The central computer determines the scheduling of the contracts and gives these data to the KRS 4201 system computer. The latter computes the priorities, machine loading and storage status for the manufacturing sequence at each work site in addition to forming the transport queue for the shelf servicing facility (RGB). (Off-line operation)

The storage administrative data (inventory of contracts and empty receptacles) is fed into the control of the RBG. Attendants can carry out operational modifications in accordance with current priorities.

h. VWP (Fixtures, Tools, Testing Equipment)

The VWP center administers all VWP's for the IGFA-C. In the VWP center there is the shelf storage with the VWP pallets and there is also the tool installation. The preparations take place in two variant forms:

i. contract-related for VWP associated with particular workpieces (up to the point of transfer into the pallet shelf storage),

ii. time-related VWP supply (transfer directly to the work site).

4. Experience and Problems

a. The configuration of the interface between TUL process and the TE plays a decisive role in continuous automation [3]. This engineering approach overcomes the hitherto familiar situation in which the parts are presented on a usually fixed-location circular storage rack which is worked through by the robot and which must be decommissioned for the subsequent job. This engineering approach also achieves a complex solution to the technical problem while remaining compatible with receptacle size I. Thus the problem of configuring the interfaces reduces itself to one of configuring the pallet changing apparatus. In addition to the direct linkup with the pallet shelf storage and hence the good contact with the working area of the industrial robot the required production floor area is also less.

b. The peripheral facilities are so designed as to be usable for different job technologies. The industrial robot, the production line apparatus and the workpiece extraction caliper, the transfer equipment and also the system pallet with its interchangeable positioning devices are all developments of the Saalfeld VEB WEMA.

c. The automated manufacturing section can be expanded step by step. In accordance with the status of science and technology technological units can be interpolated to accommodate further working techniques.

d. The arrangement of the job sites (TE) relative to one another makes possible a high order of multimachine operation and also permits the use of new insights into job organization and the structuring of collectives.

The achieved automation changes the job functioning of the operator and thus leads to his further liberation from physical and intellectually stereotyped labor.

Comparison of the Changes in Job Functions [4]

Indicator	Job-Specific Manufacturing	Automated Production Line	TE IGFA-C
Setup	x	x	x
Loading workpiece	x	Partial	
Operating	x		
Surveillance	x	x	x
Quality control	x	x	x
Physical job demands	x	Partial	
Varying percentage utilization in terms of content and time	x		

5. Economic Goal and Results Achieved

In terms of the labor productivity thus far achieved in job-specific manufacturing and in the automated production line it may be stated that there has been achieved a further increase in labor productivity of 130 percent.

The use of industrial robot technology and microelectronics has yielded a saving of 18 workers and 11 job sites.

The transit time is reduced to 50 percent.

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8008
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OPERATION OF 'PRISMA' FLEXIBLE MANUFACTURING SYSTEM

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Vol 34, No 10, Oct 84 pp 595-597

[Article by W. Schroeder, Gera VEB UNION Machine Tool Factory; Dr K. Rudolph, GDR Chamber of Technology; E. Mueller, engineer, GDR Chamber of Technology Research Center for Machine Tool Construction in the Karl-Marx-Stadt VEB "Fritz Heckert" Machine Tool Combine]

[Text] 0. Introduction

The development of technology and organization in the parts manufacturing taking place in machine construction factories occurs both in job site automation and in process-referred automation. It is characterized by the comprehensive employment of microelectronics which in turn leads to new more highly automated engineering solutions in the areas of manufacturing devices, transport technology and storage technology and manufacturing control.

In the Gera VEB UNION Machine Tool Factory there has been developed and planned in socialist communal work jointly with the research center of the machine tool construction factory in Karl Marx City a flexible manufacturing system for processing small and medium-sized prismatic individual parts. This manufacturing system was put in operation in the fourth quarter of 1983.

1. Specifications To Be Met in Developing the Manufacturing System

The specifications to be met in the development of the manufacturing system were inferred from the long-term rationalization plans of the factory which had the aim of achieving a minimal labor manufacturing process through supplementary and step-by-step automation of work sites and manufacturing sections. The most important specifications were:

i. decisive enhancement of the technological organizational level and therefore also of performance capability in the manufacture of small and medium prismatic individual parts,

ii. establishment of high flexibility in order to process a broad spectrum of parts in small batch sizes,

iii. an economically acceptable level of automation corresponding to the conditions of manufacturing,

iv. establishment of automation both materially and also information-theoretically on the basis of computer-supported planning and manufacturing control,

v. the elaboration and further definition of personality-enhancing job contents,

vi. low-investment rationalization in conjunction with extensive utilization of existing equipment and buildings,

vii. maintenance of the possibility of secondary use of component engineering features of the manufacturing system.

The economic goals were derived from the overall factory goals in terms of the development of efficiency and performance and were also derived from the national economic efficiency requirements relative to reflux time and investment quotas.

2. Characteristics of the System Components

2.1. The Processing Task and the Processing

In the "Prisma" manufacturing system about 850 prismatic individual parts differing in design, differing technologically and having the maximum dimensions 500 mm x 800 mm x 500 mm are processed. The closure level is 80 percent. The manufacturing contract size varies between 5 and 50 pieces (on the average, 24 pieces) and the number of manufacturing contracts amounts to about 3,000.

The processing is characterized by the use of the following 10 processing machines (see figure):

i. processing center horizontal transverse travel milling machine CFKrW250NC600;

ii. two processing centers horizontal transverse travel milling machine with pallet change CFKrW-P250NC600;

iii. processing centers vertical transverse travel milling machine CFKrS250NC450;

iv. vertical transverse travel milling machine with turret FKrSRS250NC450;

v. vertical milling machine FSS;

vi. horizontal milling machine FW;

vii. longitudinal lathe DLZ;

viii. serial drilling machine BKr 32 x 4;

ix. horizontal surface grinding machine SFW315.

Five bench locations are also provided in the manufacturing section for quality control, deburring, labeling and scribing.

2.2. Configuration

The "Prisma" flexible manufacturing system has the form of an integrated job-specific manufacturing section (IGFA) of the basic type C, that is, having in the middle of the system a combined storage and transport system (KLTS) on whose longitudinal sides the work sites are arranged.

The transport of the manufacturing contracts from the receptacle storage to the work sites and back is done by means of manually driven transfer carts. The equipment, tools and testing devices are similarly delivered to the workplaces by the KLTS.

2.3. Transport System and Storage System

The core of the transport system and storage system is the KLTS with its principal elements being receptacle storage, automated shelf servicing device and the transport terminal station.

The receptacle storage (42 meters long, 5 meters high) consists of two lines of shelf location with 480 stalls (5 rows and 48 columns in each line) located in the center of the IGFA. In the receptacle storage there are stored transport receptacles of size 1 (up to a maximum of 400 kg). The transport receptacles are not system-linked. The stalls are grouped into 8 input locations, 8 output locations, 91 stalls for transfer cars functioning as a connecting link with the work sites arranged along the longitudinal sides of the shelves, and 373 stalls for intermediate storage.

The shelf servicing device 8111 with its cable-lead cars and optical stall checking is microcomputer-controlled.

The transport terminal station (head station) (Figure 2) is arranged frontally and subdivided into separate input and output zones. The transport terminal station is equipped with an electric forklift and with a receptacle testing device for checking the contours of the receptacle and the weight of the transport receptacle.

2.4. VWP Provision

Equipment, tools and testing facilities (VWP) are provided consistently with the particular work sequence. A VWP attendant coordinates provision of the VWP array in accordance with the schedules assigned by the manufacturing control process. The VWP array provided (with preset tools) is delivered in a VWP receptacle with the aid of a forklift to the head station of the KLTS. The manufacturing attendant (Figure 3) verifies reception and with the

forklift completes transfer into the receptacle storage. After the work sequence has been completed the VWP is subjected to a completeness test and there then follows return of the VWP array into the VWP center.

2.5. Manufacturing Control [1]

The control is accomplished by an intermediate automation stage. This automation stage is characterized by the fact that the "work site group occupancy" function complex and additional previously stored planning functions are processed on an ESER computer and the function complexes "workplace occupancy--processing disposition" as well as "transport disposition and storage disposition" are processed on the microcomputer K1520. There results a process-decoupled operation of the computer technology. By this we mean that the coupling of the automation technology with the manufacturing process (e.g., at the workplace, at the control location, at the head station) and the coupling between the automated control functions are not carried out using computers but are accomplished by the attendants.

The manufacturing control is accomplished using the following devices:

i. operations computer EC1022,

ii. magnetic tape converter 1255,

iii. two A5130 office computers with drives for two diskettes and two cassettes or with drives for four diskettes,

iv. control computers and servicing computers for the shelf servicing device,

v. coupling computers between the office computers and control computers of the RGB,

vi. signal transmission technology.

The operations computer carries out the workplace group occupancy for the IGFA and the other manufacturing sections of the factory and controls the sequence of the entire parts manufacture. The timeliness of the data fed to the IGFA is assured by including the manufacturing section in the feedback reporting system of the progress control station.

The office computers solve problems having to do with the management of processing, control, transport and storage and in addition they provide control information to the control computer of the shelf servicing device (RBG) and finally they are available for data interrogation. The coupling computer functions as a master and after checking limit switch signals at the transfer locations it transfers the transport order from the office computer (BC) to the RBG control.

The signal transmission technology uses optical signals to establish an information link between the workplace or the control station and the attendant.

Between this technology and the office computer there exists no form of instrumental coupling.

The manufacturing control of the IGFA takes place in dialogue with the office computer. There exist programs for the following control functions:

i. acceptance of the manufacturing specifications,

ii. feedback report of manufacturing progress,

iii. work site occupancy,

iv. call for VWP setup,

v. transfer of the manufacturing orders and VWP,

vi. supplying the workplaces with manufacturing orders and VWP,

vii. discharge of manufacturing orders and VWP,

viii. management in the event of breakdown.

Over and above this there are available numerous programs for a comprehensive data service (reading, printing, modifying, supplementing, erasing data).

3. The Process of Installation

The installation of the IGFA took place simultaneously with the planning phase, especially with regard to the planning of the manufacturing control (programming and testing of the programs). The expansion of the old factory shop and the assembly of the equipment as well as the performance of the function tests of the computer technology and signal transmission technology was accomplished in 9 months. This was possible only because the testing of the computer technology and automation technology took place in parallel under laboratory conditions and because it was possible for them to be integrated in a functionally reliable way into the IGFA. It was also made possible by the circumstances that essential setup operations by the various contractors in part also took place in parallel. A positive effect has been produced by the stimulus of an interdisciplinary setup collective on the basis of a competition complex.

The following time segments subdivide the setup time period:

i. 3 months for carrying out building construction in an existing shop,

ii. 4 months for carrying out assembly of the high shelf storage,

iii. 6 months for setting up the processing machines.

It was possible to shorten by 50 percent the assembly time and operation startup time planned by the manufacturer.

Every installed machine was repeatedly used productively (the required transport processes and the manufacturing control processes took place conventionally),

iv. 8 months for setting up the manufacturing control engineering (hardware and software) together with the automation technology,

v. 9 months for a complex test of the entire manufacturing control engineering.

Parallel to setting up the "Prisma" IGFA the VWP center was also set up and put into operation by purely in-house efforts. With respect to the functional effectiveness of the "Prisma" IGFA great importance attaches to correct handling of the interface between the preceding planning process and the technological preparation. To this end

a. the organizational principles of the overall factory were left unchanged and the necessary interconnection programs were created;

b. the IGFA was included in long-planned plant organization arrangements such as

i. computer-aided elaboration of technological documents (PRO 11);

ii. machine printout of the APSK by means of the EDVA EC 1022;

iii. machine printout of manufacturing documents including the manufacturing facilities survey sheet;

iv. inclusion in the central EDP project "manufacturing control" (INWEMOS, Project Section 6);

v. the construction of new central files (FM storage, VWP catalogue);

vi. the interfaces are organizationally protected and the conformability of intermeshing processes is guaranteed.

4. Secondary Use of the Results

It was one of the aims of this research enterprise to develop with the "Prisma" IGFA a complex engineering solution which would be usable in a secondary way for factories of the NVI under the same or similar manufacturing conditions.

The results amenable to secondary use may be classified as

i. results in the object domain,

ii. results in the method domain.

The following results are available for secondary use:

i. activity-oriented operations sequence plan for preparing and planning integrated automated manufacturing segments,

ii. CNC-600 subprogram technology for zero-point shifting in the case of the CFK4W250 with rotary table,

iii. technological documentations for prismatic workpieces,

iv. documentation for the receptacle checking device TB 1, for transfer cars servicing the workplaces, for equipment serving to guide the transfer car into the shelf areas, for VWP receptacles of the KLTS, for high shelf storage with transfer equipment in VWP storage,

v. configuration of the transfer locations in the head station,

vi. GAB verification for KLTS, VWP center, for determining the IGFA safety quality,

v. storage order for VWP center,

vi. organization engineering for integrated VWP provision via KLTS,

vii. engineering type solution for manufacturing management using a Robotron A 5130 office computer for signal transmission technology without direct computer coupling,

viii. engineering for computer coupling and process signal production,

ix. "attendant workplace 1" program system,

x. task descriptions for special planners in the trade associations for construction (on former building sites), electrical work, compressed air,

xi. layout in the use of NC machines (CFKrW, CFKrW-P, CFKrS, FKrSRS),

xii. guidelines for the economic evaluation of integrated manufacturing segments.

5. Prospects

After the completion of several months of system testing it can be asserted that the "Prisma" IGFA flexible manufacturing system has proven itself. That is to say, the developmental requirements have been met. Present economic evidence shows that labor productivity has risen 160 percent, the investment rate is 1.51 and a reflux period of 2.9 years has been achieved.

However, it has become apparent that stable permanent operation of the IGFA requires additional activities to guarantee a high usability of all component systems and to assure adherence to the plan. The planned performance

parameters are attainable and can be exceeded. The results obtained during the phase extending up to stable steady-state operation are being subjected to a quantitative analysis and are being evaluated.

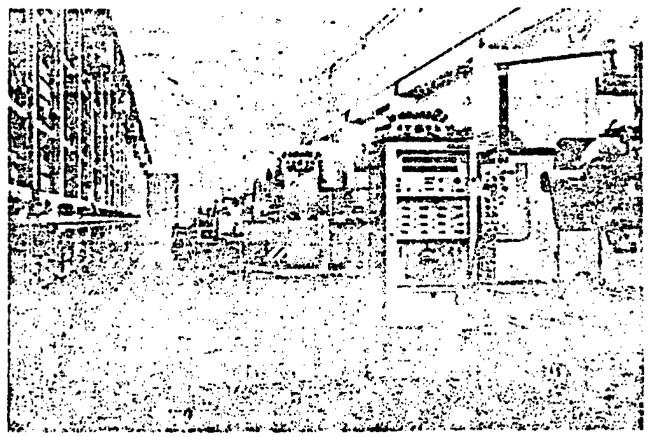

Fig. 1. Vertical-horizontal processing centers of the VEB Machine Tool Factory Auerbach and shelf with transfer cars in the lower shelf row.

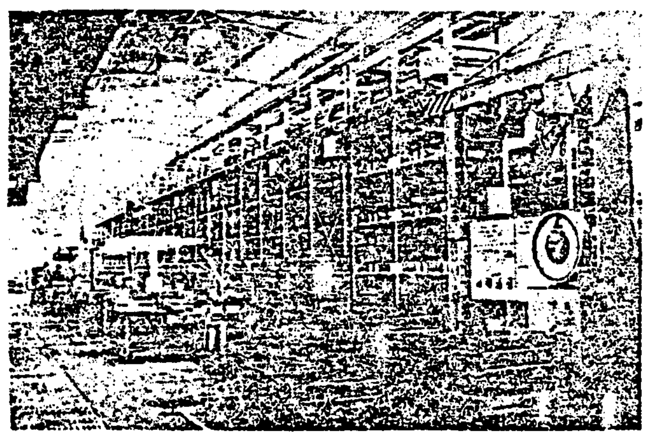

Fig. 2. Head station with receptacle testing device including weighing scales and incoming and outgoing storage merging traffic.

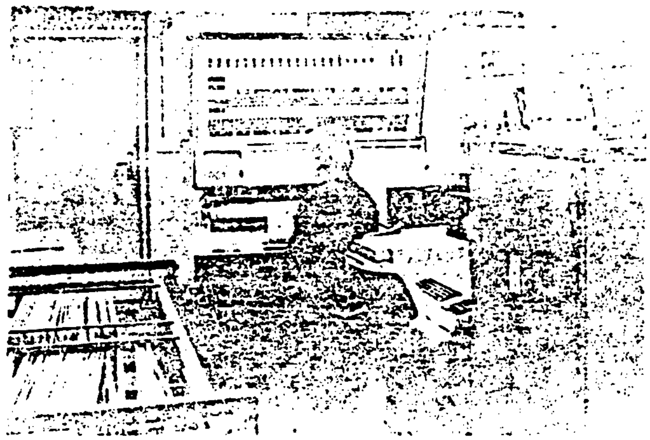

Fig. 3. Attendant's place with optical display for production completion reports and for office computers.

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8008
CSO: 2302/46

TECHNICAL INTELLECTUALS STILL SHORT-CHANGED

Budapest MUSZAKI ELET in Hungarian No 25, 6 Dec 84 p 1

[Article by J. G.: "Moral, Material Recognition of Technicians: Waiting for Incentive"]

[Text] The Hungarian economy is about to change step. It will be decided in the years ahead whether we are able to meet the global economic challenge. One of the conditions for changing step is that we manage well with the most important creator of value, the human mind. The greatest obstacle to this is that we do not adequately respect those who can contribute to the development of the economy with their creative activity. We shall deal with the material and moral respect for the technical intelligentsia in our article and in our report published on page 3.

The ratio of those doing intellectual work increased at a swift pace in the past 3 1/2 decades. According to the 1980 census data the number doing non-physical work exceeds 1.5 million. This is 31 percent of the active earners. Within this the number with high level degrees is almost half a million. This intellectual strength had an important share in the successes achieved in socialist construction.

In recent years a number of problems piled up in the income situation of the technical intelligentsia, in their working and living conditions and in the moral and material recognition of them; and the failure to solve these problems had an unfavorable effect on their activity, on the effectiveness of their work. Solving these problems is absolutely necessary if we are to make profitable use of the energy residing in this stratum and put in into the service of our socio-economic development. A good number of these problems are rooted in the income matters of the technical intelligentsia.

After the liberation significan changes took place in the income and wage ratios of the active population. Reducing the unjustified wage differences between branches, trades and occupation groups was a correct tendency from both the political and economic viewpoint. But beginning in the 1950's the levelling process still effective today went beyond those limits within which wage differences still represented a driving force for the several social classes and strata to acquire a higher level of knowledge and professional training.

Decreasing Differences

The wages of technical employees, according to some statistics, were still double the wages of industrial workers in 1949. In 1957 this ratio fell to 160 percent, in 1971 to 151, in 1975 to 141 and in 1979 to 136 percent. If we also take into consideration various supplemental allowances applying only to manual workers this figure is even smaller, 111-112 percent. Today, as a final result, the earnings of non-managerial engineers hardly exceed those of skilled workers, and often remain below them.

A reduction in earnings differences according to training is a world trend accompanying an increase in the economic development level, but in our country these differences are a good bit small than in economically developed capitalist countries, and even less than the similar values for socialist countries.

The development of these differences did not take by surprise those doing research on Hungarian society. But for a long time it was not acceptable to talk about this because, as it were, the workers were the leading force of society so it was natural that their income should increase more quickly than that of the other parts of society. Thanks to the mechanical implementation of this principle it happened that year after year the technical stratum had a relatively smaller share in wage development, which finally led to the development of a situation which hinders further development in a number of ways. The phenomenon could be addressed for the first time when the levelling among the various workers strata also exceeded normal size and unskilled workers earned no less than those trained on the job and the latter frequently surpassed skilled workers in wages--this could no longer be explained by the leading role of the working class. Nor could this explain why the workers--remaining within their own class--should not be interested in acquiring higher professional knowledge.

The process outlined above led to a degradation of knowledge in general and to a developing unpopularity of intellectual careers, including those of the technical intelligentsia. After we ended categorization according to origin indications came from the universities that the number and ratio of students of worker-peasant origin were decreasing. So many began to formulate the question: Would a Hungarian worker of today gladly send his son to study for 5 years after graduating from secondary school if he saw that he would earn less than if he were sent for skilled worker training? This factor also stands behind the diminished interest. And when we announced the SZET [skilled workers to attend universities] action the differences became even more striking. A worker earning an average of 6,000 or 8,000 forints would go to a university, would receive the same average wage there at first, then would go back to work as an engineer and earn half this much, if he could get such a sum. And when the scholarships for university training were standardized (and reduced)--in order to eliminate unjustified differences--a precipitous decrease in interest followed.

The process outlined has led to a decline in interest in our technical universities. People with low points are being admitted to some schools and

technical colleges. The so-called skimming possibility of universities and colleges has decreased greatly. Naturally if the initial primary material is not of proper quality the final product--highly trained factory engineers, engineers and other technical experts--will no be of truly high quality. At the same time, very many of the technical people working in such careers--recognizing the trends here--have left for areas in which it seems assured that their income can increase dynamically. Especially many opportunities for such migration were offered initially by the auxiliary operations of producer cooperatives, by smaller enterprises and by cooperatives and more recently by small enterprises and private undertakings.

A person might ask after this: Why did Hungarian industry and technology not note earlier that this trend was harmful? The depressed income level and declining prestige of the technical intelligentsia, the intellectual carriers of technical-economic renewal, can be explained in a fundamental way by the insensitivity of industrial production to innovation; and they may have been hidden by this also. Forces which would encourage the enterprises and workers to achieve ever greater performance do not function with sufficient effectiveness in our economic development. An environment lacking market impulses does not favor creative intellectual experts with an enterprising spirit desiring the new. We might say that only a very few of our economic units really express a need for high level intellectual activity; at times the personnel and material conditions for research and development are not ensured.

Wage and Base

Unfortunately the material recognition and situation of the technical intelligentsia became critical when the world economy presented our economy with a challenge greater than ever before, when the ratio shifts and deterioration in the terms of trade absorbed, in the past 10 years, the equivalent of our entire national income for a year.

It is true that we could formulate things differently. In this global economic situation it became clear that the only way to adapt to the situation was an ever fuller exploitation of the intellectual potential, mobilizing the gray matter of the country for innovation, for technical development. And this is possible only if we restore the prestige of technical careers and increase the moral and material recognition of the technical intelligentsia.

We have to extricate ourselves from this situation not despite the difficult situation but rather because of it; we must improve the material recognition of the technical intelligentsia even in this more difficult period. And what increases even more the difficulties of the adjustment is that while a contrary process took place under the conditions of central guidance, the liquidation of the lack of proportion in wage payment is today an enterprise task; so it is very important to change attitudes, to convince people that improving the material circumstances of the technical intelligentsia is an all-social interest.

The adjustment can take place in a way conforming to the mechanism if the enterprises use their own resources (institutions managing out of the state budget are an exception), in such a way that those doing really effective

creative work should have a share in it, and not those who belong to the technical intelligentsia on the basis of formal features. Thus, naturally, there should be differentiation in this area also, according to jobs and according to enterprises, but it will help the realization of this principle that manpower flows to those places where it is employed effectively and where they can pay accordingly.

Recognition and Respect

It follows from the independence of our enterprises that in many places they are not waiting for central incentive to increase the material and moral recognition of the technical people. The pay of technical people has improved a great deal in the Hungarian Optical Works and the Beloiannisz Signal Technology Factory. In a number of factories the workers themselves have considered it important to give everything available for wage development or the more significant part of it in a given year to those technical people whose work is contributing to seeing that the enterprise can master its market difficulties.

Despite these favorable signs a determined and high level policy position must be taken to change the attitude which has developed so that a considerable change should take place in enterprise wage policy practice.

It would have significant stimulating effect if those creating it should have a share of the extra profit achieved by virtue of developments or innovations realized, even if it does not come from an invention or innovation. Even technical people who are not leaders, but subordinates, should get increasing pay for improving work.

There are also problems in the moral recognition of the technical intelligentsia. The system for honoring creative people offering technical performance is not broad enough or varied enough. Greater significance should be given to various state prizes for creative work; prizes should be established within the enterprises for outstanding technical people.

Improving material recognition of the technical intelligentsia is an important step. This is not a short-term process, for developing correct payment ratios can take place only over a number of years. More years will be required for society to take cognizance of the changes, for the balance to be restored, for the admissions committees of the technical universities and colleges to again be able to select among those desiring a technical career. And we must wait for the "final product" to appear. But we must set about restoring the prestige of technical careers, because this is one of the most important conditions for our development.

8984
CSO: 2502/23

BRIEFS

VIDEOTON COMPUTER PRODUCTION--In 1983, the Computer Engineering Factory of VIDEOTON manufactured computer equipment worth over 5 billion forints. Of this, computers and peripherals worth 1.2 billion forints were sold to Hungarian consumers. The products it displayed at the 1983 Budapest fair represent what will be available in Hungary and for export during the Seventh Five-Year Plan. At the 1984 Budapest fair VIDEOTON exhibited a new complete family of microcomputers. The smallest of these, the "TV Computer," is equally suited for playing videogames in color or black and white and for serious educational purposes. The next member of this family is the VT-16 designed to be used as a professional personal computer. It has an 8 and a 16-bit central unit. The former allows its use for previously evolved applications while the 16-bit mode permits its use for newer developments. VIDEOTON continues to pursue its policy of outstanding quality and delivering systems complete for each intended application. The upswing in demand for microcomputers has led to a growing need for printers compatible with them in price. VIDEOTON meets it by producing small printers at a mixed Hungarian-British enterprise established especially for this purpose. VIDEOTON's new R 11 and SZM 52 machines represent a significant advance in higher performance computers of greater reliability. The factory continues to manufacture proven and successful equipment such as the VT 20 systems, the VDT and VDN terminals and the 27,000 and 23,000 line of printers. [Text] [Budapest IPARGAZDASAG in Hungarian No 8-9 Aug-Sep 84, p 55]

CSO: 2502/27

POLAND

NEW ENGINEERING PRODUCTS REVIEWED

Frequency Converter

Warsaw PRZEGLAD MECHANICZNY in Polish No 20, Oct 84 p 28

[Article by (M.Z.): "Frequency Converter for Delivering Power to Induction Motors"]

[Text] The Poznan Enterprises for Manufacturing and Installation of Electric Equipment in Construction produces the TPC-6.5 thyristor frequency converter (see figure), which converts three-phase 380/220 V power line voltage into an output voltage of a variable frequency and intensity. The principal purpose of the equipment is to supply power to three-phase induction motors in drive systems where control of rotation speed is necessary.

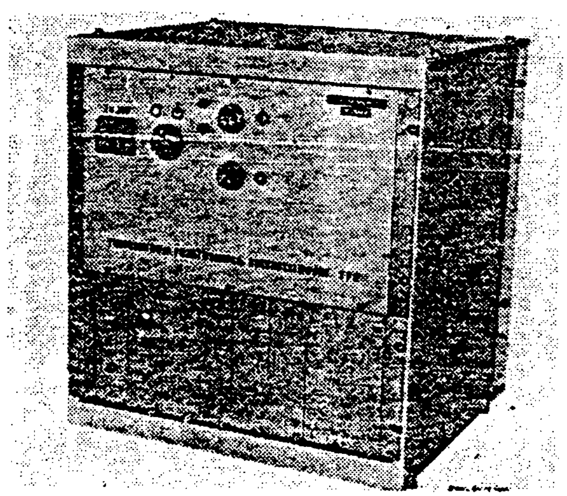

Fig. 1

The converter controls the rotation speed of the motor by changing the output frequency in the range of 0-80 Hz and changes the direction of rotation by changing the sequence of output voltage phases without an interruption.

The converter consists of two design components: the control assembly and the power assembly. The control assembly ZS-1-02 comprises electronic systems on individual printed circuits placed in blocks contained in a CAMAC-4U cassette. The power component is available in two options: ZE-6.5-1-02 and ZE-6.5-2-02, and is made as a panel, with the main element being the converter block placed on a mounting plate inside the panel. In the first version, it has the switches and safeguard components and control phase and indicator lamps placed on the front panel. The second version has the converter unit and the masking front plate.

The ZS and ZE components are housed in a metal sheet box made according to standard PN-79/E-08106 and are also available without the box (version IP-00) to be installed in the customer's cabinet. The outside connection and control cords are led into the box through a ring clamp. An advantage of the converter is that it is produced domestically (until now, such units were imported from the West) and the fact that it is made almost exclusively from domestically produced components.

Technical Features of the Thyristor Frequency Converter TPC-6.5

Input rated voltage of motor, 380/220 V, 50 or 60 Hz; rated motor voltage, 380/220 V, 50 or 60 Hz; output frequency range, 0-60 Hz; voltage and intensity of control units regulating frequency, -10-+10 V and -5-+5 mA, respectively; operational temperature, -10 to +40°C; degree of shielding, IP-00, IP-20, IP-22, and IP-40; maximum apparent loading, 6.5 kV·A; maximum effective motor power, 5 kW; maximum voltage of phase current, 12 A; external dimensions for IP-00, 482 x 363 x 443 mm; weight, 42 kg.

The converter can be furnished, in addition, with an M-TPC-01 manipulator for remote control of the contactor, actuating the converter and specifying the rotation speed of the motor, and with controller N-TPC-01 for remote control of motor rotation speed.

The thyristor frequency converter TPC-6.5 has been awarded a gold medal at the International Fair in Poznan in 1984.

Casting Plant Monitoring Devices

Warsaw PRZEGLAD MECHANICZNY in Polish No 23, Dec 84 pp 26, 27

[Article by (M.Z.): "Measurement and Control Unit for the Casting Industry"]

[Text] The Wadowice Production and Testing Enterprises of Casting Equipment [WADAP] manufactures more than 50 pieces of equipment falling in the following groups:

--systems for evaluation of the basic physical and engineering properties of materials and molding mixes;

--equipment and instruments for control of properties of materials and molding mixes used in special processes;

--equipment and instruments for control of liquid metal;

--other auxiliary equipment.

Recently, the following units were brought into production.

• LPU equipment for fast determination of the type of bond and moisture content of molding mix, designed by the Institute of Technology and Machine Building of Wroclaw Polytechnic. Measurements are done with an ultrasound technique based on a comparison with a reference value.

The equipment consists of a measurement chamber and tester 543 made by Unipan. The tester works with two ultrasound heads (transmitter and receiver), which operate on a frequencey of 1000 kHz and are fixed inside the measurement chamber (in a horizontal position).

The LPU unit can measure moisture content with an accuracy of ±0.2 percent, and material strength accurate to ±5 percent.

• LCTs system for evaluation of the molding mix susceptibility of producing casting defects. The units consists of a heating component with a power source (with a thyristor power regulator), a hydraulic press DHPA5 (which makes specimens of the tested molding mix), a steel form with support and a press power drive.

The susceptibility for casting defects is measured by time (seconds) between the placement of the specimen above the heater and the falling-off of a layer of the mix subjected to radiation.

The technical features of the LCT system are: specimen size (diameter and length), 160 and 120 mm; heating temperature, 100°C; and measurement time, 5 min.

• Laboratory three-position dryer LAp-3b. The dryer operates in the temperature range of 105-110°C; the sample weight is 100 g.

• LW-1 system for chemical indication of moisture content. The range of moisture content measurement is up to 10 percent of H2O; sample weight, 6 g.

• LWZ system for evaluating of the technological characteristics of resins (hardening time and ductility). The equipment operates in the temperature range of 0-250°C; specimen weight, 1 g.

• LS-2 system for measurement of the roughness of casting products. The needle step is 2 mm; the distance between two measurement points is 2.6 mm; accuracy of reading, 0.01 mm.

• LV-Cl system for binding time measurement. The equipment has an element penetrating into the molding mix with diameter 4.0 mm (the penetrator into hardening components has a diameter of 1.1 mm) and a pressure of 2.94 N.

• LCZ system for measuring the time of hardening of binder and hardener mixes. The stirring unit of the equipment rotates at 1150 rev/min. The time measurement accuracy is ±0.1 min.

• Automatic LUW-CA system measuring the shock strength of cores. The unit has a piston performing the work of 1.63 J per stroke. Cores of diameter and length of 50 mm are tested.

• LOP system for measuring the ductility of molding mix by the shatter test technique. The specimens of 50 mm in diameter and length weigh 150 g. The throw height with the Gittus method is 1829 mm, and the fall height is 814 mm.

• LPP system measuring adhesion of coatings on forms and cores made of a sand mix. A dried or hardened specimen is 50 mm across and 50 mm long. The equipment uses compressed air with pressure 0.02-0.6 mPa.

All systems are powered from standard power lines of 380/220 V, 50 Hz, but can be adapted to other power sources if needed.

Heat Exchanger

Warsaw PRZEGLAD MECHANICZNY in Polish No 22, Nov 84 p 26

[Article by (M.Z.): "Integrated Heat Exchangers for Clustered Heating Centers"]

[Text] The Mikolowo Enterprises for Construction of Coal Industry Installations produces a system of exchangers for clustered heating centers of CO type and for CW systems of water heating, which can be used for assembly of heating plants of a capacity of 1.5 to 10 mW (Fig. 1). The systems include: high productivity heat exchangers JAD (two or four) installed horizontally, circuit pumps (CO systems), circulation and loading pumps (CW systems), insulation and safety elements, control and measurement instruments and filters.

These components are assembled into a system by means of pipe circuits housed in a portable frame. Insulation is provided by metal sheet jackets filled with layers of insulating material. The concept provides for easy assembly into systems and convenient operational conditions with easy access to pumps, fixtures and measurement units.

Technical features of systems of central heating CO/2 (CO/4): rated capacity, 750 (1500) kW; nominal temperature of heater water and heating water, 150/80 and 95/70°C, respectively; working pressure of heater water and heating water, 1.6 and 0.8 mPa, respectively; outside dimensions, 1420 (1900) x 800 x 2150 mm; weight, 613 (1007) kg.

Technical characteristics of hot water systems CW/R/2 (CW/R/4) assembled in a horizontal configuration: rated capacity (summer), 315 (575) kW; maximum hot water flow capacity, 6 (11) tons/hour; nominal temperature of heater water in winter and summer seasons, 150/80 and 70/40°C; nominal temperature of hot

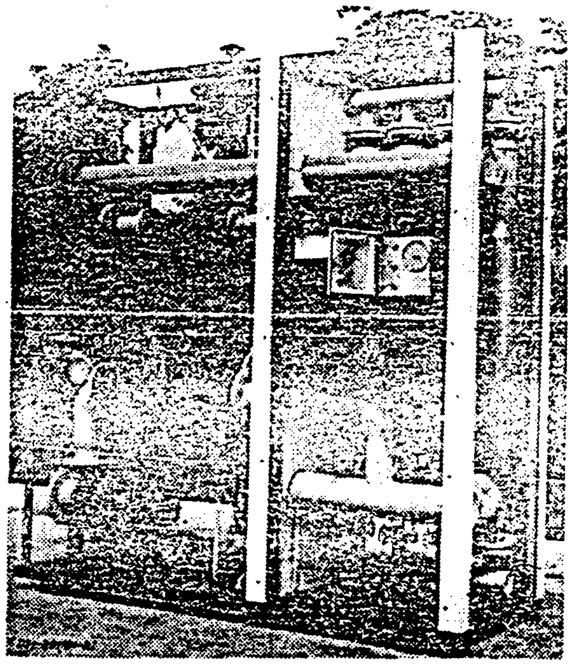

Fig. 1

water supplied, 5/50°C; working pressure of heater and hot water, 1.2 and 0.8 mPa, respectively; outside dimension, 1410 (1865) x 650 x 2150 mm; weight 556 (792) kg.

Technical characteristics of hot water system CW/S/2 (CW/S/4) in a serial-parallel configuration: rated capacity (summer), 315 (575) kW; maximum hot water circulation, 6 (11) tons/hour; nominal temperature of heater water in winter and summer, 150/80 and 70/35°C, respectively; nominal temperature of circulated hot water, 5/50°C; working pressure of heater water and hot water, 1.2 and 0.8 mPa, respectively; outside dimensions, 1565 (1815) x 1090 x 2150 mm; weight, 779 (1016) kg.

Side-Boom Crane

Warsaw PRZEGLAD MECHANICZNY in Polish No 22, Nov 84 pp 26-27

[Article by (M.Z.): "SB-85 Side-Boom Crane for Pipe Laying"]

[Text] The side-boom crane SB-85 (see figure) produced by Stalowa Wola Metal Works is intended for transportation and hoisting in the building of energy pipelines. The hydraulic drives and control of the boom, hook and counterweights ensure an easy control of operation. A broad range of continuous control of the load lifting and lowering speed allows optimum speed of load manipulation.

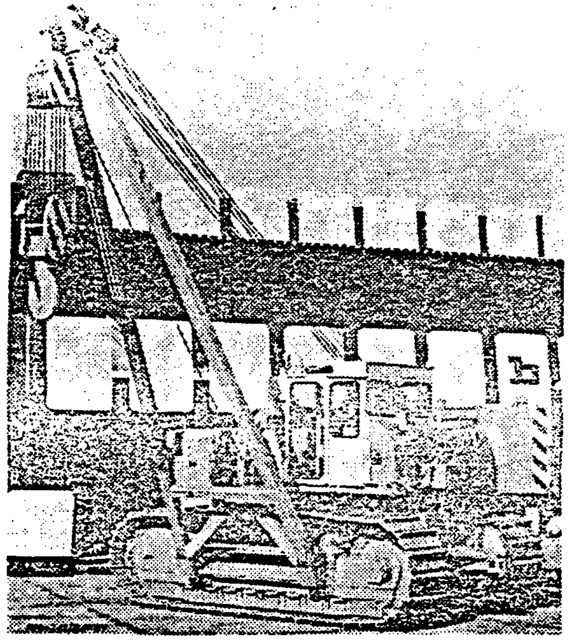

Fig. 1

The large distance between crawler tracks and their great length ensures the stability of the crane and a capacity for movement on a sloped terrain. A large ground contact surface of crawler tracks reduces the ground pressure. There is an option of using wider crawler tracks for even further decrease of the pressure on the ground.

The power drive system consists of: motor DTI-817C-IHC; a six-cylinder engine with direct injection; water cooling and stroke capacity of 13.4 dm^3; one-stage moment converter of the diameter of 409.4 mm and dynamic ratio at full stroke of 2.84:1; gear box (three-gear toothed transmission with constant tooth wheels and intermediary shaft, switchable under load with hydraulic power shift control); turning system (an independent two-gear planetary transmission with hydraulic control of each crawler, allowing easy operation of the tractor and turning in place) and two-stage working planetary transmission with chain wheels.

The transport system consists of the traction frame made of high-resistance sheet metal, eight track wheels and two support rollers (on each side) and track chains over a standard width of 864 mm, or broader track chains of 1016 mm. The ground contact surface for standard tracks is 6.74 m^2, and for specially wide tracks 7.93 m^2. Each chain consists of 45 plates.

The movement speed for low gears (forward and reverse) are: 1LO, 2.8 and 3.4 km/hr; 2LO, 3.7 and 4.5 km/hr; 3LO, 4.8 and 5.8 km/hr; and for the high gears: 1HI, 5.8 and 7.1 km/hr; 2HI, 7.1 and 86. km/hr; 3HI, 9.3 and 11.3 km/hr.

The operator cab is in the middle of the tractor and has a heater and sliding doors.

Technical characteristics of side-boom crane SB-85: load capacity at stabilization limit, 1000 kN; engine power, 231 kW at 2100 rev/min; operation weight, 60,500 kg; overall length, 5775 mm; width in movement, 4040 mm; width of tractor with standard tracks, 3455 mm (with special tracks, 3607 mm); width with counterweights in working position, 5783 mm; height with cab, 3575 mm; length of track contact with the ground, 3904 mm; range, 1220-7320 mm; boom length, 7320 mm; boom weight with blocks, 3230 kg; maximum height to hook, 6092 mm; hook lifting speed to low and high levels, 0-4.75 and 0-9.50 m/min; hook lowering speed for the two levels, 0-4.50 and 0-9.00 m/min; counterweights hydraulically controlled, thrust-out type; weight of counterweight frames, 2750 kg; ballast loads, four segments, 2525 kg each; winch weight, 2070 kg; disk breaks with automatic hydraulic release.

Capacities: fuel tank, 627 L; engine coolant, 93 L; hydraulic oil tank, 250 L; engine crankshaft, 39 L; transmission turning mechanism and moment converter, 250 L; side transmissions 2 x 77 L; hook and boom winch, 2 x 18 L.

Steel cables: hook cable, nine-strand, 7/8 in x 106 m (diameter x length); boom cable, six-strand, 7/8 in x 74 m.

The machine is furnished with the following safety devices: boom stop preventing the boom from exceeding its maximum upper angular position and boom angle indicator.

The side-boom crane for pipeline construction has been awarded a gold medal at the 56th International Fair in Poznan in 1984.

9922
CSO: 2602/17

PROGRESS IN MICROELECTRONICS REVIEWED

Bucharest REVISTA ECONOMICA in Romanian No 52, 28 Dec 84 pp 13-14

[Article by Dr Ioan Batrana: "Microelectronics--the Technology for Increasing the Reliability of and Miniaturizing Electronic Equipment"]

[Text] Microelectronics is industrial innovation for the purpose of raising economic efficiency in machine building; it is not a choice,* it is the technical and economic solution for international competition in the '80's, '90's and later. This pragmatic definition of microelectronics expresses the objectives of technological progress for all of industry's products of modern machines in whose structure electronic equipment has percentages of 40-80 percent of their exchange value. Progressive growth in reliability provides rising use values, and miniaturization reduces the material and energy consumption in the manufacture and operation of modern machines.

The way in which these technological desires are fulfilled is based on the electronic installations' artificial intelligence,[1] supported functionally by data-processing programs and materially by microprocessors, by linear and logic circuits and by high-capacity electronic memories in a small physical volume. These are the microelectronic circuits whose dimensions are halved every 5 years and whose costs drop 28 percent with each doubling of the volume of production.

There have thus been developed industries for integrated electronic circuits in silicon, which provide to data-processing equipment and systems the redundancy necessary to functional reliability[2] and the flexibility necessary to artificial intelligence, for the achievement of efficient automation of technological processes and administrative activities and for complex automation of the management of economic or social systems.

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* "...it is like a gold rush; those who do not hurry will miss the boat; those who do not manage to take the lead are left behind forever; those who do not manage to participate in the competition are handicapped forever..." (Michel Schwartz, "Responsabilitatea Guvernamentala fata de Tehnologie, Politica in Legatura cu Microelectronica in Europa Occidentala" [Governmental Responsibility for Technology, the Policy in Connection with Microelectronics in Western Europe], 1981).

The industries and economic and social processes in Romania require electronic means for achieving the planned jump in productivity, and the electronics industry is developing its production and conception capacities in order to create for itself the components, technological equipment and data-processing programs needed for maximum integration[3] of electronic technologies: (1) installation and maintenance services, (2) manufacture of specialized electronic apparatus and equipment, (3) manufacture of computers and data-processing programs, (4) manufacture of technological components and equipment and (5) manufacture of materials of electronic purity.

The technologies for electronic components have the economic importance of materially providing continuity to the manufacture of electronic equipment and the political importance of independence in the development of new products of the electronics industry, they being called the "heavy industry" of the field of electric, electronic and mechanical machine building.

With particular importance being accorded to the field of electronic components as far back as in the decisions of the Ninth RCP Congress, the development of capacities for production and for scientific research has been oriented consciously toward the providing of integrated technologies or, in other words, technologies independent from the embargo policies of the monopolistic states. This industrial policy has had remarkable results in the field of minicomputers and in the field of professional radio-communication equipment, there being achieved exceptional and surprising international approval that has attracted orders and contracts for exports to the People's Republic of China, the GDR, the Czechoslovak Socialist Republic, the Soviet Union and the Hungarian People's Republic, for products of our own devising.

Electronic components are regarded by the designers of electronic equipment as functional and constructive elements or modules of the equipment; they are pursued as products of intense technological progress that supports an international competition in electronic components, with performances oriented toward applications[4] as follows: low costs are priorities for electronic apparatus for wide consumption; reliability, a condition for aviation, transportation, nuclear power stations and complex automation; low consumption of electric power, a condition for equipment that is mobile, portable or placed at great distances; dimensions, important for aviation and computers; and the operating speed is divided into classes corresponding to the dynamics of the processes served.

The special programs for power generation, for data processing, for agriculture and food and for the exportation of mechanical, electric and electronic machines require electronic components in 304 technological classes, of which 153 technological classes were manufactured in Romania in 1984, which will rise to 268 technological classes in the 1986-1990 5-year period; the providing of all the classes and types of electronic components needed by the electronics industry has international cooperation as a solution. The CEMA member countries secure their supply of electronic components through balanced trade exchanges, since the manufacture of electronic components in all the countries uses residual imports based on convertible currency for materials, for subassemblies and for equipment that is made in the world by a small number of

producers that secure the competitive outputs in the technologies for electronic components.

The worldwide problems of energy and raw materials have produced financial and human changes in the technological problems of automatic optimization, of cybernation of the most complex technical, economic and social processes, whose solutions are found in the technologies for semiconducting devices, forcing the integration of more and more complex functions of intelligence into silicon chips; thus, technological progress in the field of semiconducting components continues even during economic recessions, it being subsidized by national and military budgets through programs for priority development.

The evolution of semiconducting electronic components from discrete devices to circuits with simple functions, integrated into a silicon structure, and, at present, to circuits with complex functions, integrated into monolithic silicon structures, is marked by radical changes in the carriers of technological information; discrete semiconducting devices proliferated through technological documentation, simple integrated circuits proliferated through technological and design specialists, but the technologies for complex integrated circuits cannot be passed on without equipment.[5] This is equipment automated for technical reasons, in particular, which achieves submicron constructive elements, correlates physical and chemical parameters with molecular precision and provides products with a very great variety of functions.

The technologies for advanced integrated circuits (VLSI [very-large-scale integration]) require a new generation of technological equipment (a technological module contains 50-60 types of equipment) that processes silicon chips with a diameter up to 150 mm, achieves with a precision of 0.2 microns functional elements with dimensions below 1 micron and achieves 6-10 layers of functional networks in a depth of 10-15 microns in the monocrystal of the chip.

The competitive equipment in the 1987-1990 period is highly productive equipment organized according to groups of technological processes whose material and information flows are controlled automatically by computers. The hardware and software structures of the technological equipment needed for manufacturing VLSI integrated circuits are unusable without the specific programs for each function of an electronic circuit that it will produce serially or without the specific programs for each process for processing the silicon structures; in other words, the acquisition of a piece of technological equipment with its operating documentation represents only 20-25 percent of its use value.

Concentrations of forces for designing and continually modernizing the technological equipment and for providing the production capacities for technological equipment can be achieved for the entire list of equipment only through international cooperation and specialization in which middle-sized and small industrial countries can also participate; they are personally interested in an effort to balance the imports needed for supplying all the types of equipment of a technological module, which, for manufacturing advanced integrated circuits (VLSI), come to investment values of $25-30 million.

The majority of the producers of technological equipment for electronic components assemble constructive and functional elements achieved through technologies specific to machine tools, to elements of optics and precision engineering, to aircraft equipment for aeronautics and to installations for the chemistry and metallurgy of monocrystals--for which the high vacuum needed in the equipment for electronics, high precision, high temperatures, functional reliability, and resistance to corrosive substances are conditions with special standards that require redesigning and supplementation of technological operations beyond those of the conventional machines for mechanical, chemical or thermal processing; these additional efforts are accepted reluctantly because of the short duration (4-5 years) of the cycle of obsolescence of the equipment for the technologies of microelectronics.

The cooperation of the "self-equipping" of the electronics industry with the production capacities of the industries for machine tools, for elements of optics and precision engineering and for special installations for high temperatures, high pressures and intense chemical attack is a basic necessity for the development planned for the 1986-1990 5-year period, both for meeting the equipment production's need for elements and for filling the existing production capacities in the above-mentioned collaborating industries with complex products with sale guaranteed through international specialization of the industry for microelectronic components.

As the domestic need for technological equipment for microelectronic components is much less than the demand for equipment at the level of all the CEMA countries, the valuta resources needed for the imports for the supplementation of equipment required and for the residual imports of materials and semiproducts required for the production of advanced integrated circuits (VLSI) are achieved through specialization of our equipment-production capacities in the above-mentioned industries.

The cooperation and specialization program set up by the CEMA member countries, also including Romania, in order to reciprocally meet their need for materials, microelectronic components and technological equipment, contains technological objectives that reduce the delay in the international competition in technological progress (noted in 1982 as being about 5 years) for the work of miniaturization, of growth in reliability and of growth in labor productivity, so that, in 1989, the microelectronic components required by the electronics industries may become competitive and may meet their entire need.

The exacting technologies of microelectronics process materials that are achieved as peak products in many industries;[6] practically all industries normally contribute to providing materials, spare parts and accessories for microelectronics.

Besides their great diversity (solvents, acids, salts, inks, gases, deionized water, monocrystals, metals, glassware, filters, developers, photoresists, resins, diluents and so on), the high degree of perfection and performance that is required of them is an essential characteristic; for example, the processing chemicals must be delivered and manipulated with amounts of atomic impurities below 0.1 parts per million and with 1-micron insoluble particles

below 10,000 per liter. The purity of the composition and the conditions of cleanliness in manipulating these chemicals also extend to their containers.

The program for assimilating in Romania the materials needed in microelectronics makes provision for securing 25 percent of the list in 1985 and for adding another 15 percent through balanced exchanges with the CEMA member countries, with the entire need for primary and auxiliary materials in the 1986-1990 5-year period being met through reciprocal deliveries under the convention on specialization for microelectronics.

The technical and organizational problems in the development of microelectronic circuits in Romania were presented in a work[7] with conclusions referring to reducing the technological gap existing in 1983 and utilizing the human and material potential that we possess on the Baneasa industrial platform. The implications of a social nature in the development of microelectronics are continually studied both at governmental levels and in the academies of sciences of all the states with intensive economic and social development, there resulting objectives of the policy of industrial development and of the social and cultural policy. The directions of the basic research needed for microelectronics in the '90's have been presented to the Academy of Sciences of the Socialist Republic of Romania through the work of Prof Mihai Draganescu,[8] which supports the attainment of the objectives established through the decisions of the 13th RCP Congress for "economic and social development in the 1986-1990 5-year period" and of the objectives for "Romania's economic and social development up to the year 2000."

At present, the microelectronics on the Baneasa platform has concretized the following objectives of technological progress from which tasks derive for all branches of the national economy: 1. The achievement, through our own forces, of a relatively large number of families of technologies and technological equipment for our own microelectronics program and for our country's participation in the program for supplying computer technology to the CEMA member countries; 2. The assimilation, through our own forces, of the materials specific to the technologies for microelectronic components; 3. The consolidation of the competitive results obtained thus far, so that for some of the families of electronic components in the current program the world technical level may be attained and, accordingly, consistent exportation may be achieved; 4. The tackling of long-term directions in the research so that, in the future, products and technologies achieved at performance levels that exceed the world level may exist in the country. The above-mentioned objectives constitute the data of development without precedent in the history of the development of the national electronics industry and are comparable, in level of boldness, to the similar program of Japan or of other advanced countries in this field.[9]

Of the conditions needed for this development, the most feasible--which does not entail expenditures in convertible currency and difficulties like those connected with embargo policies--seems to be the providing of technical personnel, namely microelectronics engineers, through the founding of the semiconductor and microcomputer sections in the Electronics Faculty of the Bucharest Polytechnic Institute, which would meet the need for approximately 100

graduates per year for the 10 technological units on the Baneasa industrial platform.

In closing, we draw a number of more important conclusions:

1. Microelectronics is the technological and economic solution for competitiveness in the products of the mechanical, electric and electronic machine-building industry; it is the technology that provides for the growth in productivity planned for the '80's and '90's. All countries with programs for intensive development are engaged in this technological effort.

2. Economic efficiency in the industrial production of microelectronic components, and independence in the development of new products that contain microelectronic equipment, are achieved through active participation in international cooperation and specialization; the cooperation arranged beginning in 1982 in this field, with the CEMA member countries, will meet the computer industry's need for microelectronic components.

3. The industry for microelectronic components is becoming an industry of convergence for the other industries, in which it is necessary to specialize production and research-design capacities, for materials, semiproducts and equipment with special technical conditions; such products will be in demand on the international market in the '80's, '90's and later.

4. The social implications of the proliferation of microelectronics converge toward the spiritual development of man, whose training as a working person must be rethought both for the direct workers in the field of microelectronics and for the workers in the fields utilizing microelectronic equipment.

FOOTNOTES

1. Mihai Draganescu, "Economic and Social Development in View of the Second Industrial Revolution," ERA SOCIALISTA, No 19, 1978.

2. D. K. Lynn, C. S. Meyer, D. J. Hamilton, "Retrospect and Prospect," Ch 16, "Analysis and Design of Integrated Circuits," McGraw-Hill, New York, 1967.

3. Mihai Draganescu, "Electronics in Romania"--introductory text for the term "Electronics" in "Enciclopedia Romaniei" [The Encyclopedia of Romania], 1979.

4. Ioan Batrana, "Problems and Objectives of the Development of the Technologies for Semiconducting Electronic Components," AUTOMATICA SI ELECTRONICA, No 1, 1984.

5. Ioan Batrana, "Utilajele de Productie--Obiective Majore ale Cercetarilor Tehnologice Pentru Componente Electronice" [Production Equipment--a Major Objective of the Technological Research for Electronic Components], CAS [State Insurance Society], 1984.

6. Constantin Bulucea, "Asupra Materialelor Pentru Microelectronica" [On Materials for Microelectronics], 1980.

7. Radu Barsan, "Asupra unor Aspecte Specifice ale Cercetarii si Productiei de Structuri Pentru Circuite Integrate MOS/LSI" [On Specific Aspects of the Research and Production of Structures for MOS/LSI [Metal-Oxide Semiconductor/Large-Scale Integration] Integrated Circuits], 1983.

8. Mihai Draganescu, "Problemele Microelectronicii" [The Problems of Microelectronics], 1984.

9. Constantin Bulucea, "Nota Privind Introducerea Profilelor de Specializare 'Semiconductoare' si 'Microcalculatoare' la Facultatea de Electronica" [A Note on the Introduction of the "Semiconductor" and "Microcomputer" Fields of Specialization in the Electronics Faculty], 1984.

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YUGOSLAVIA

BRIEFS

DOMESTIC MICROCOMPUTER--Zagreb VJESNIK in Serbo-Croatian on page 13 of its 3 February 1985 issue carries an advertisement for the "new Orao microcomputer." The microcomputer is an "achievement of domestic joint production" by two basic organizations of associated labor: Velebit Informatika of Zagreb and PEL Elektronika of Varazdin. According to the ad, the computer sells for 89,000 dinars [approximately $400] and is available for immediate delivery with guaranteed service. The add recommends the computer for use by schools, private citizens, small businesses and laboratories. It has a capacity of 16 K Basic and includes a monitor and connections for a cassette recorder, printer and TV antenna. For information and sales, the reader is referred to Velebit, OOUR Informatika, Zagreb. [Editorial Report]

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